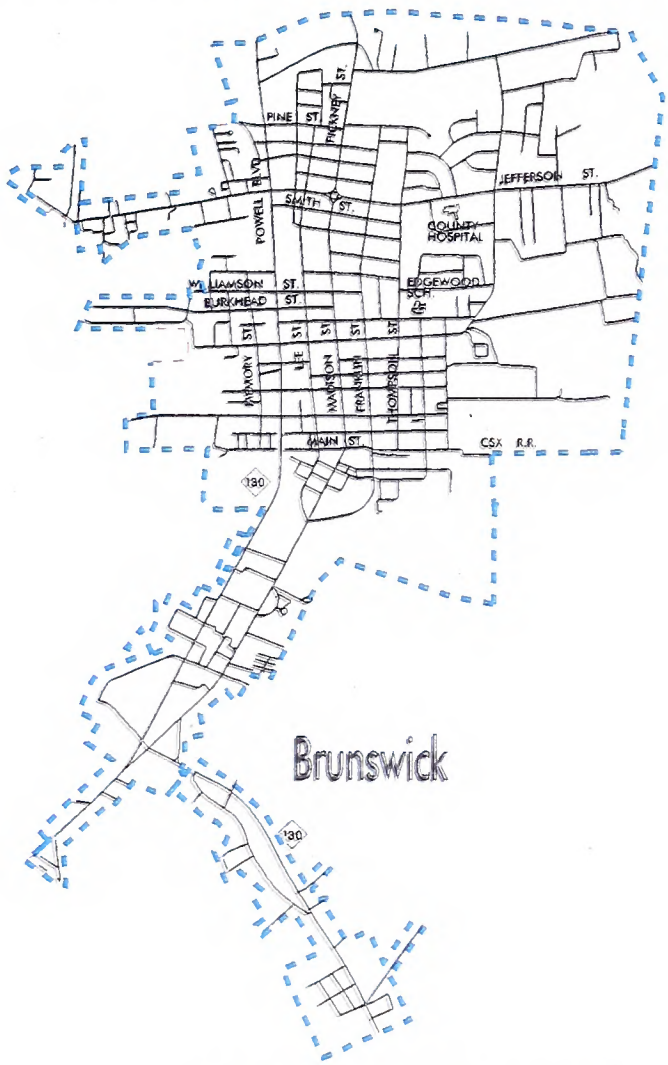
North Carolina Department of Transportation
Division of Highways
Statewide Planning Branch

WHITEVILLE–BRUNSWICK

THOROUGHFARE PLAN TECHNICAL REPORT



JANUARY, 1997

1996 THOROUGHFARE PLAN
TECHNICAL REPORT
FOR
WHITEVILLE/BRUNSWICK URBAN AREA

Prepared By:

The Statewide Planning Branch
of the Division of Highways
of the North Carolina Department of Transportation

In Cooperation With:

The City of Whiteville
The Town of Brunswick

The Federal Highway Administration
of the United States Department of Transportation

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January, 1997

Deborah Hutchings PE
5-9-97

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THOROUGHFARE PLAN ADOPTION DATES

City of Whiteville	August 27, 1996
Town of Brunswick	August 19, 1996
Recommended Approval by Statewide Planning Branch	October 30, 1996
NC Dept. of Transportation	December 6, 1996

1. INTRODUCTION

Transportation plays a vital role in the development of an area. Business, industrial, and residential communities use it daily as a way of life. A thoroughfare plan takes the needs of these communities and provides a good, safe, and efficient highway system for the present and future.

This report describes the update of the Whiteville/Brunswick Urban Area Thoroughfare Plan. It will be used as guidance by the State of North Carolina and the urban area in the development a highway system sufficient for travel demands through the future year 2020. The City of Whiteville has been concerned with transportation for some time. The first thoroughfare plan study was developed in 1964. The second thoroughfare plan study was completed in 1980. This update includes the Town of Brunswick in the planning area whereas it did not in the two previous studies. The City of Whiteville is the county seat for Columbus County. The City of Whiteville and the Town of Brunswick are located in the southeast region of the State. Figure #1 shows this urban area in relation to the State.

The system of thoroughfares proposed follows the basic Principles of Thoroughfare Planning as described in Chapter 2 of the report. Many benefits are derived from thoroughfare planning. The primary objective is to enable major thoroughfares to be progressively developed that will adequately service future traffic demands. The location of thoroughfares depends on field investigation, aerial photos, existing and anticipated land uses, environmental concerns and topographic conditions. It also considers the travel concerns of the community and its public representatives.

Major benefits derived from thoroughfare planning are:

(a) A minimum amount of land will be required for street and highway purposes.

(b) Local citizens will be aware of the streets that will be developed as major thoroughfares and thus will have assurance that their residential street will not become a major traffic carrier.

(c) Land developers can design their subdivisions so that their streets will function safely and efficiently.

It should be emphasized that the recommended plan is based on anticipated growth and current trends of the planing area. Prior to construction of specific projects, a more detailed study will be required to reconsider development trends, specific locations, design requirements, and environmental needs.

GEOGRAPHIC LOCATION FOR WHITEVILLE – BRUNSWICK

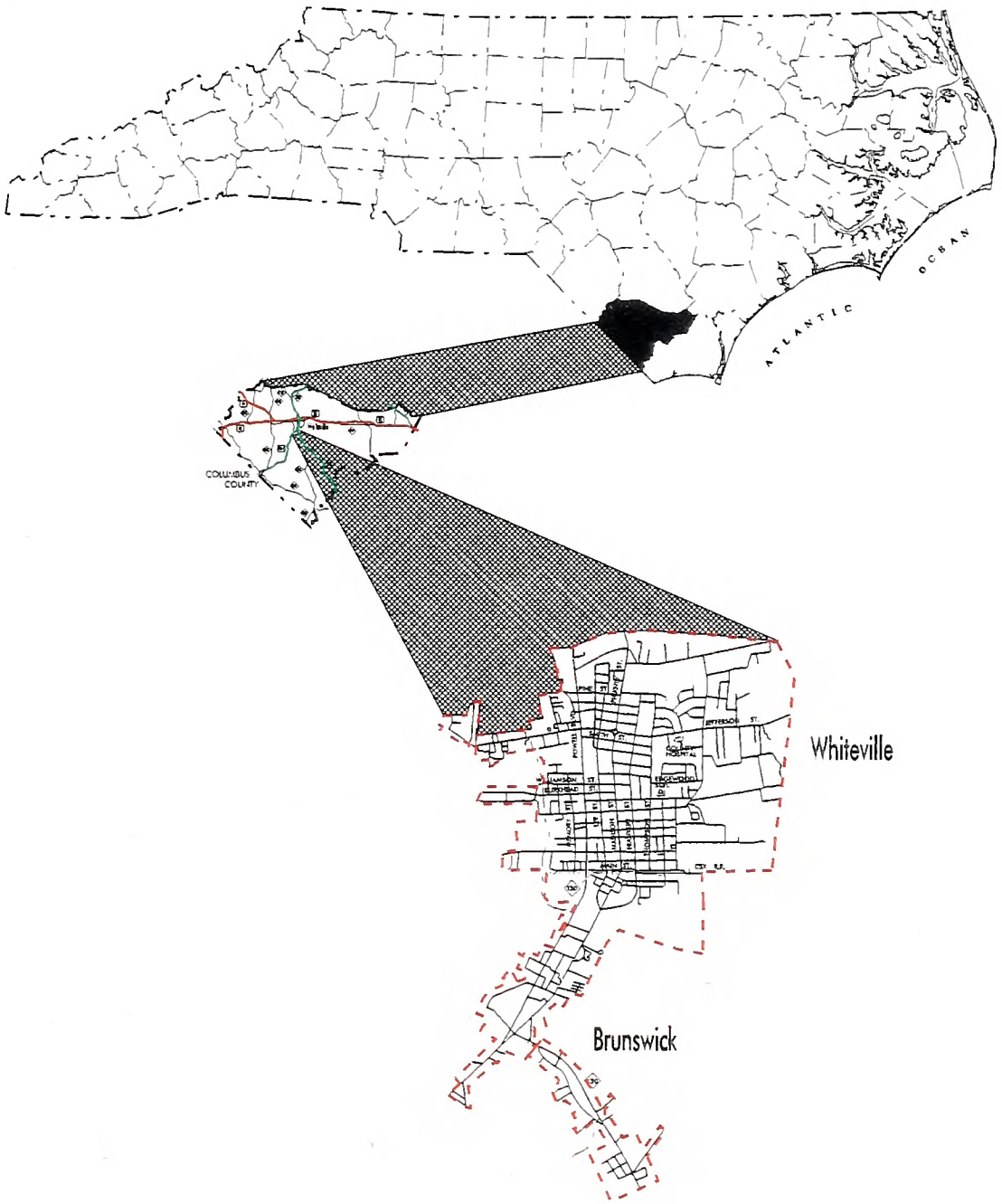


FIGURE 1

2. THOROUGHFARE PLANNING PRINCIPLES

This chapter explains the basic principles and the purpose of transportation planning. System and operational efficiency are also defined. Finally, the idealized thoroughfare plan system is described.

Basic Principles

The urban street system typically occupies 25 to 30 percent of the total developed land in the urban area. Since the system is permanent and expensive to build and maintain, much care and foresight are needed in its development. Thoroughfare planning is the process used by public officials to assure the development of the most logical and appropriate street system to meet future travel desires. The major steps involved in the thoroughfare planning process are:

(1) **Collection of data** concerning existing physical development and travel desires (origin, destination, and mode of travel) within the area.
(2) **Development of a model** which reflects present travel desires.
(3) **Prediction of future socioeconomic data,** and computation of future travel desires using the model.
(4) **Evaluation** of the adequacy of the existing street system in serving present and future travel.
(5) **Formulation of the best thoroughfare plan**, based on travel demand, economic benefits, and environmental considerations, to meet future travel desires.
(6) **Development of construction priorities** for plan implementation.
(7) **Implementation** of the plan.

Purpose of Planning

Many benefits are to be gained from thoroughfare planning, but the primary objective is to assure that the street system will be progressively developed in such a manner as to adequately serve future travel desires. Thus, the cardinal concept of thoroughfare planning is that provisions are made for street and highway improvements so that as needs arise, feasible opportunities to make improvements exist.

Some benefits derived from thoroughfare planning are:

(1) Each street can be designed to perform a specific function. This permits savings in right-of-way and construction costs, and encourages stability in travel and land use patterns.

(2) Local officials and citizens are informed as to future improvements. Public facilities can be better located, and damage to property and appearance can be minimized (for example: buildings and plants can be located to permit future street widening).

(3) Residents will know which streets will be developed as major thoroughfares and can make an informed decision when choosing a home.

(4) City officials will know when improvements will be needed and can schedule funds accordingly.

Efficiency

The improvement of the efficiency of existing facilities can be achieved through the improving of the **system** and **operational efficiency** of thoroughfares.

System efficiency can reduce travel distances, time, and cost. Improvements in system efficiency can be achieved through the concept of functional classification of streets and development of a coordinated major street system.

Functional Classification - Streets perform two primary functions - they provide **traffic service** and **land service.** These two functions are incompatible. The conflict is not serious if both traffic and land service demands are low, but when traffic volumes are high, conflicts created by intense land service demand result in **congestion.** The thoroughfare plan provides a functional system of streets which permits travel with directness, ease, and safety. Different streets in the system are designed to perform specific functions thus minimizing the traffic and land service conflict. Figure 2 illustrates the relationship between traffic service and land service. Streets can be categorized as: local access streets, minor thoroughfares or major thoroughfares.

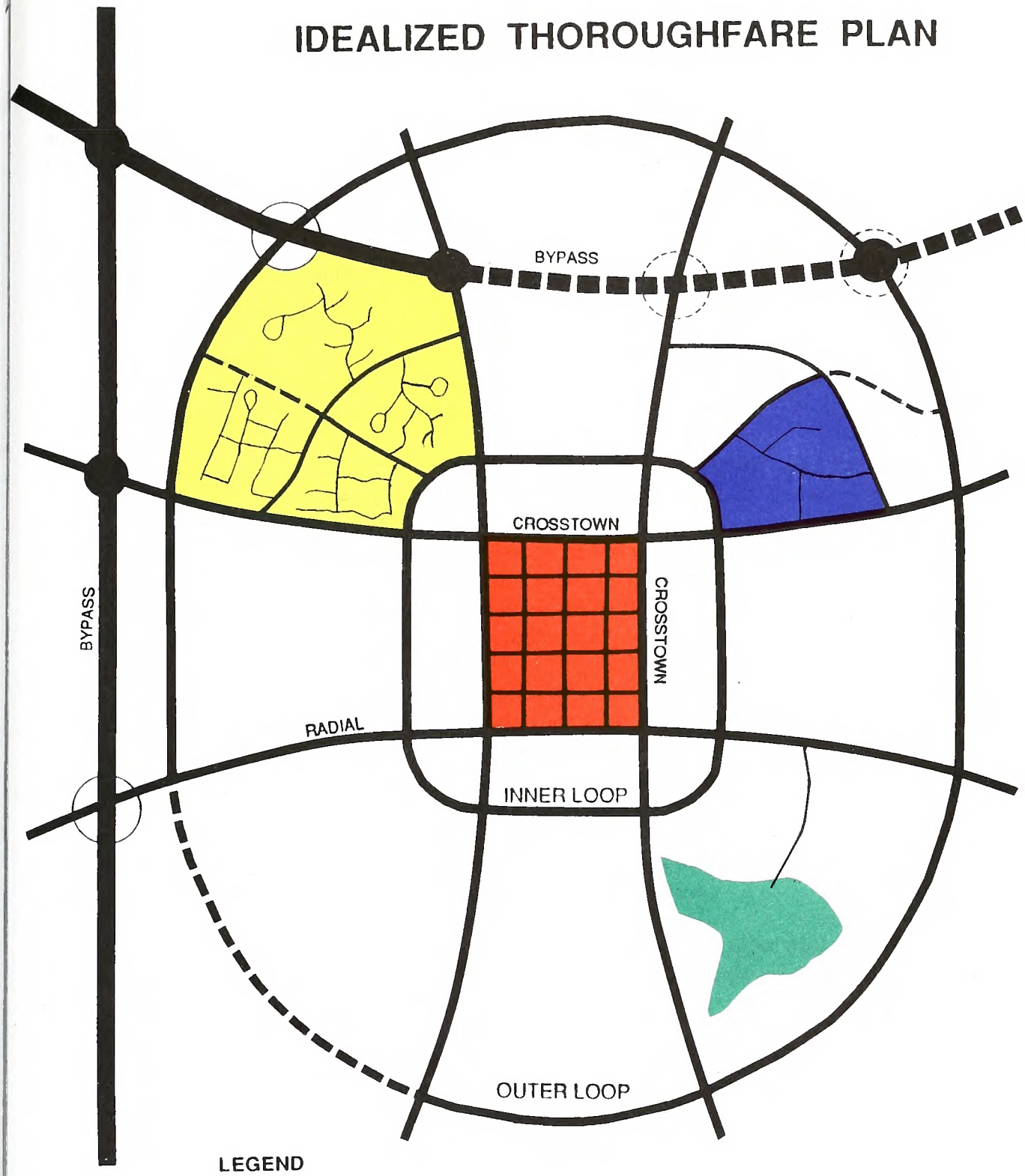
Local Access Streets provide access to abutting property. They are not intended to carry heavy volumes of traffic and should be located such that only traffic with origins or destinations on the streets be served. **Their function is to provide access.** Depending upon the type of land use that they serve, local access streets may be further classified as residential, commercial, and/or industrial.

Minor Thoroughfares are important streets in the city system. They collect traffic from local access streets and carry it to the major thoroughfare system. They may, sometimes, supplement the major thoroughfare system by aiding minor through movements. A third function that may be performed is that of providing access to abutting property. They should be designed to serve limited areas so that their development as major thoroughfares will be prevented.

Major Thoroughfares are the primary traffic arteries of the city. Their function is to move intra-city and inter-city traffic. Streets that comprise the major thoroughfare system should not serve abutting property. **Their major function is to carry traffic.** Major thoroughfares may range from two lane streets to expressways with six or more traffic lanes. As a rule, parking should not be permitted on major thoroughfares.

Operational Efficiency increases the capability of the street to carry vehicular traffic and people. In terms of vehicular traffic, a street's **capacity** is defined as "the maximum number of

IDEALIZED THOROUGHFARE PLAN



LEGEND

	EXISTING	PROPOSED
JOR THOROUGHFARE REEWAY		
AJOR OTHER		
NOR THOROUGHFARE		
CAL ROAD		
TERCHANGE		
RADE SEPERATION		

LAND USES

- COMMERCIAL/BUSINESS
- RESIDENTIAL
- INDUSTRIAL
- PUBLIC/INSTITUTIONAL

FIGURE 2

vehicles that can pass a given point on a roadway during a given time under prevailing roadway and traffic conditions." Capacity is affected by the physical features of the roadway, nature of traffic, and weather.

Physical ways to improve vehicular capacity would include street widening, intersection improvements, improving the vertical and horizontal alignment, eliminating roadside parking and eliminating property access points.

Operational ways to improve street capacity include:

(1) **Control of access** - A roadway with complete access control can carry more than twice the traffic handled by a non-controlled access street.

(2) **Parking removal** - Increases capacity by providing additional street width for traffic flow and reducing friction to flow caused by parking operations.

(3) **One-way operation** - The capacity of a street can be increased up to 50%, depending upon turning movements and overall street width, by initiating one-way traffic operations. One-way streets can also improve traffic flow by decreasing potential traffic conflicts and simplifying traffic signal coordination.

(4) **Reversible lanes** - Reversible traffic lanes may be used to increase street capacity in situations where heavy directional flows occur during peak periods.

(5) **Signal phasing and coordination** - Uncoordinated signals and poor signal phasing restrict traffic flow by creating excessive stop-and-go operation.

Altering travel demand is a third way to improve the efficiency of existing streets. Travel demand can be reduced or altered in the following ways:

(1) Encourage people to form carpools and vanpools for work and other trips. This reduces the number of vehicles on the roadway while increasing the people carrying capability of the street system.

(2) Encourage the use of mass transit, bicycles, and pedestrian travel.

(3) Encourage industries and business to stagger work hours or establish variable work hours for employees. This will reduce travel demand in peak periods and spread peak travel over a longer time.

Idealized Thoroughfare Plan System

A coordinated system of major thoroughfares forms the basic framework of the urban street system. A major thoroughfare system that is most adaptable to desired lines of travel within an urban area and which permits movement between various areas of the city with

maximum directness is the radial-loop system. This system consists of several functional elements--radial streets, crosstown streets, loop system streets, and bypasses. An idealized thoroughfare plan showing the described facilities is also included in Figure 2.

Radial streets provide for traffic movement between points located on the outskirts of the city and the central area. This is a major traffic movement in most cities, and the economic strength of the central business district depends upon the adequacy of this type of thoroughfare.

If all radial streets crossed in the central area, an intolerable congestion problem would result. To avoid this problem, it is very important to have a system of **crosstown streets** that form a loop around the central business district. This system allows traffic moving from origins on one side of the central area to destinations on the other side; to follow the central area's border; and allows central area traffic to circle and then enter the area near a given destination. The effect of a good crosstown system is to free the central area of crosstown traffic, thus permitting the central area to function more adequately in its role as a pedestrian shopping area.

Loop system streets move traffic between suburban areas of the city. Although a loop may completely encircle the city, a typical trip may be from an origin near a radial thoroughfare to a destination near another radial thoroughfare. Loop streets do not necessarily carry heavy volumes of traffic, but they function to help relieve central areas. There may be one or more loops, depending on the size of the urban area, and they are generally spaced one-half mile to one mile apart, depending on the intensity of land use.

A **bypass** is designed to carry traffic through or around the urban area, thus providing relief to the city street system by removing from it traffic that has no desire to be in the city. Bypasses are usually designed to through-highway standards, with control of access. Occasionally, a bypass with low traffic volume can be designed to function as part of an urban loop. The general effect of bypasses is to expedite the movement of through traffic and to improve traffic conditions within the city. By freeing the local streets for use by shopping and home-to-work traffic, bypasses tend to increase the economic vitality of the local area.

Application of Thoroughfare
Planning Principles

The above descriptions are of an idealized major thoroughfare system. In actual practice, thoroughfare planning is done for established areas and is constrained by existing land use and street patterns, topography, public attitudes, and expectations of future land use. Compromises must be made because of these, and other factors that may affect major street locations.

3. THE 1996 ADOPTED THOROUGHFARE PLAN

This chapter will discuss the travel service of each corridor as it relates to the entire system of roads, recommended improvements for the adopted thoroughfare plan, and the public involvement process. The 1996 Adopted Thoroughfare Plan is shown in Figure 3. Facility type explanations are found in Chapter 2 - Thoroughfare Planning Principles.

FREEWAYS

US 74/76 Bypass

US 74/76 Bypass is the area's only freeway. It provides service for through traffic from Charlotte, Rockingham/Hamlet and Wilmington. Motorists using the US 74/76 Bypass have three easily accessible interchanges into the Whiteville/Brunswick urban area.

MAJOR THOROUGHFARES

US 701 Bypass/NC 130

This corridor traverses the entire planning area from north to south. It is a major radial which carries local, regional, and statewide traffic. Commercial development has increased along this corridor making its practical capacity diminish.

Western Bypass

The Western Bypass in essence is a bypass for US 701Bypass. As commercial development continues to grow on US 701 Bypass, long range future traffic on US 701 Bypass may begin to worsen capacity. The Western Bypass would provide developmental opportunities for the area. In order to assure that the Western Bypass does not develop the same problems as US 701 Bypass, it is essential that partial control of access be provided.

NC 130

This corridor is located mainly in the Brunswick and south Whiteville area. It provides access for the Columbus County Airport and the fairgrounds. NC 130 not only links the Whiteville/Brunswick area with the Coastal beaches of North and South Carolina; but it is a Hurricane Evacuation Route for them. One of Columbus County's largest employers, National Spinning, lies off of NC 130.

US 74/76 Business/NC 130

This corridor traverses the northern planning area from east to west. It is a major radial which mostly carries local traffic and regional traffic. Columbus County Hospital lies off of US 74/76 Business along with other medical complexes and some industrial land uses. The Historic Columbus County Courthouse located in a functioning traffic circle also lies on US 74/76. The

area around the traffic circle is projected to be under pratical capacity by the design year. Four lanes are recommended in this area. Therefore parking removal from Franklin Street to Lee Street is a must since the City of Whiteville eliminated the one-way operation between Madison Street and Franklin Street. The intersection with US 701Bypass is also under pratical capacity by the design year 2020. Here the pavement width is wide enough to restripe to four lanes and make intersection improvements from Lee Street to near Grove Street. These areas should be studied further as the urban area grows and traffic congestion increases.

US 701 Business/Madison St./Pickney St.

This facility traverses the heart of Whiteville area from north to south. Madison Street begins at US 74/76 Business and continues south to the intersection of US 701Bypass and NC 130. Pickney Street also begins at US 74/76 Business but continues north to the city limits. This facility goes through the central business district of Whiteville. It is presently under practical capacity around the central business district. NCDOT recommended a one-way pair system with Franklin Street to remedy this problem. The City of Whiteville, however, elected not to include this one-way pair, but instead eliminate on street parking. See the Franklin Street description under the Thoroughfare Plan Improvements section for improvement details on page 18.

Franklin Street & New Extension (SR 1953)

Franklin Street also traverses the Whiteville area from north to south. It has mostly resisdential land uses and carries local traffic. It presently parallels Madison Street/ Pickney Street almost its entire length. Franklin Street with its proposed extension would be the northbound movement with Madison Street if the one-way pair system is ever implemented. The implementation of the Franklin Street extension was started in the 1960's (project # 9.7064201) but for some reason (possibly funds) never built. NCDOT did purchase and still owns one tract in fee and 8 tracts by easement. See the Franklin Street description under the Thoroughfare Plan Improvements section for improvement details on page 18.

Lewis Street/Old Tram Road (SR 1159)

This facility from US 701 Bypass to US 74/76 Business provides a crosstown movement for traffic moving through the heart of Whiteville. (See minor thoroughfares, page 18.)

Pinelog Road (SR 1437) & SR 1436/Virgil Street

This facility is a westside radial for the planning area. It brings in traffic from the rural regional area into the heart of Whiteville. Pinelog Road has been recently upgraded to the 1994 Highway Capacity Manual standards for a rural two lane road, but SR 1436 which is presenly a dirt road will need to be upgraded as future traffic demands increase. Virgil Street picks up at US 701 Bypass and proceeds into downtown Whiteville.

Smynra Road (SR 1552)

This facility is a northwest radial which also brings in traffic from the rural regional area.

INNER LOOP

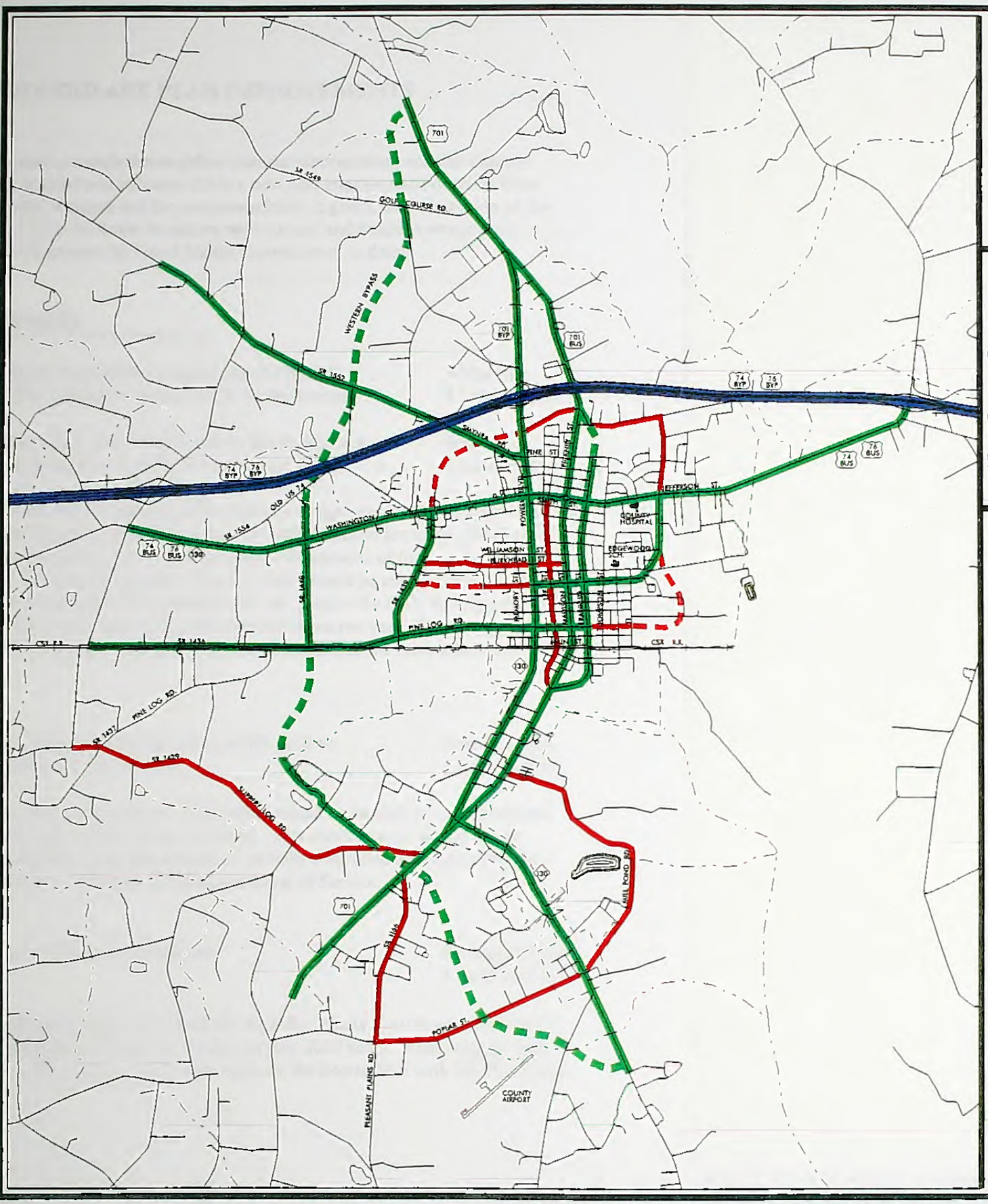
A loop system handles traffic between outlying areas and act as a connector between radials. A collection of major and minor thoroughfares make up an inner loop system around Whiteville. These facilities are Pinelog Road/Virgil Street, Health Center Road with extension, SR 1705 (Flowers/Pridgen Road), Brick Yard Road, Warrior Trail, Spivey Road, and Old Tram Road with Connector.

MINOR THOROUGHFARES

Minor Thoroughfares in the Whiteville/Brunswick Urban Area Thoroughfare Plan carry out a collector and distributor function. They perform a greater land service function than do the major thoroughfares. Listed below are the minor thoroughfares in the planning area.

Burkhead Street - Health Center Road to Madison Street
Flowers/Pridgen Road (SR 1705) - US 701 Bypass to US 701 Business
*Health Center Road - Pinelog Road to US 701 Bypass
Lee Street - US 74/76 to US 701 Business
*Lewis Street - Health Center Road at Landsdowne Drive to US 701 Bypass
*Mill Pond Road (SR 1920) - US 701 Business to NC 130
*Old Tram Road Connector - from Old Tram Road near Edgewood to Virgil Street
Pleasant Plains Road (SR 1166) - US 701 to Popular Street
Popular Street (SR 1170) - Pleasant Plains Road to NC 130
*Slippery Log Road (SR 1429) - US 701 to West Planning Boundary near Pinelog Road
Spivey Road - US 74/76 Business at Old Tram Road to Warrior Trail
Virgil Street - Franklin Street to the Old Tram Roan Connector
Warrior Trail - Spivey Road to Brick Yard Road

*See the Thoroughfare Improvements section for details on specific improvements on page 18.



LEGEND

	EXISTING	PROPOSED
FREEWAY	▬▬	▬ ▬ ▬
MAJOR	▬▬	▬ ▬ ▬
MINOR	▬▬	▬ ▬ ▬

ADOPTED BY:

WHITEVILLE	8-27-96
BRUNSWICK	9-19-96
PUBLIC HEARINGS	6-11-96
RECOMMENDED APPROVAL BY STATEWIDE PLANNING	10-30-96 M.R. Poole
N.C. DEPARTMENT OF TRANSPORTATION	12-6-96

N

FIGURE 3

AUGUST 5, 1996

THOROUGHFARE PLAN FOR THE WHITEVILLE / BRUNSWICK URBAN AREA

COLUMBUS COUNTY
NORTH CAROLINA

PREPARED BY
NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS-STATEWIDE PLANNING BRANCH

IN COOPERATION WITH THE
U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION

SCALE

0 1 MILE

0 5000 FEET

Base map date
DECEMBER 1994

THOROUGHFARE PLAN IMPROVEMENTS

This section gives details on each thoroughfare plan recommendation, and the capacity deficient areas. The facility is listed and indicates if it is a new plan improvement or taken from the old plan. The improvement location and the recommendation is given, then discussion of the recomendation. Appendix A lists the Street Inventory with current and future Average Daily Traffic (ADT). Appendix B discusses the Travel Model Development in detail.

MAJOR THOROUGHFARES

US 701 Bypass *New Plan*	1) North Planning Boundary south of SR 1002 (Old Lumberton Road) to US 74/76 Business	Widening 5 Lane Facility
	2) Pine Log Road/Virgil Street to South Planning Boundary north of SR 1170 (Popular St.)	Widening 5 Lane Facility

This facility is one of two which will be capacity deficient in the design year 2020. The deficient areas on this route will be the present two lane sections. As traffic demand increases, this facility should be first priority to be improved. This will allow proper movements of through traffic in and out of the planning area as congestion grows. Further study should be addressed in removing Bridge # 42 over the CSX Railroad at the time of widening. At present the CSX Railroad dead ends at White Marsh Swamp and only utilizes this corridor two times per year. Removing the bridge and lowering the US 701 Bypass would provide better access into the central business district of Whiteville.

Western Bypass *New Plan*	North Planning Boundary south of SR 1002 to NC 130 south of SR 1170	New Location 5 Lane Facility

This facility is a long range traffic improvement. This facility would be needed as traffic increases on the built improvement above (US 701 Bypass widening). This improvement should not be needed before the design year 2020. It should be built as partially controlled access to maintain a level of service C for a long time. Appendix D2 discusses Level of Service.

US 74/76 Business *New Plan*	Franklin Street to Grove Street	Restripe&NoPark. 4 Lane Facility

This corridor includes a functioning traffic circle with the Historic County Courthouse in its center. This corridor will become deficient in capacity as the design year 2020 nears. Removing on street parking and restriping this corridor to 4 lanes will also improve the intersection with US 701 Bypass

while providing the 4 lane continuity along US 74/76 inside the city limits on the eastern side.

NC 130 *New Plan*	US 701 Bypass to the South Planning Boundary south of SR 1171 (Harrelson Crossing)	Widening 5 Lane Facility

This corridor will also be capacity deficient in the design year 2020. It will begin nearing practical capacity approaching the design year. This corridor is also a Hurricane Evacuation Route for the Coastal Beaches. A left turn lane should be considered on Oak Street (SR 1950) for traffic leaving the large employer National Spinning.

Madison/Franklin St. & Ext. *Old Plan*	Madison: Franklin St.extension to SR 1705 near swamp Franklin: SR 1705 near swamp to proposed extension to Brick Yard Rd. at US 701Business	Parking Removal on Madison St.

The Central Business District (CBD) on Madison Street is presently deficient. This section will continue to be over practical capacity in the design year and also become deficient in the area near the Historic Courthouse, if no improvements are made. An alternative to removing parking on Madison Street or widening is to implement a one-way pair with Franklin Street. The City of Whiteville, however, deleted the one-way pair operation recommended in the old plan (1980 Thoroughfare Plan.) Therefore parking removal on Madison Street is recommended. The extension of Franklin Street would provide a northern connection for the one-way pair if the city wished to put it back into the thoroughfare plan through a plan revision. Appendix E lists the Advantages and Disadvantages of a One-Way Street System.

MINOR THOROUGHFARES

Health Center Rd. & Extension *Old Plan*	Pinelog Road to US 74/76 Extension from US 74/76 Business to US 701 Byp at SR 1705 (Brick Yard Rd.)	Upgrade 2 Lane Facility

This facility provides for crosstown movements and opens land up for potential development. It also would be part of an inner loop system.

Lewis St. & Extension *Old Plan*	Extension from Maulsby Drive to tie in with Landsdowne Drive	2 Lane Facility
	From Maulsby Drive to US 701 Bypass	No Change

This facility provides for crosstown movements and opens land up for potential development.

Old Tram Rd. & Connector *Old Plan*	Connector from near Edgewood Circle to Virgil Street	2 Lane Facility

This facility provides for crosstown movements and opens land up for potential development. It also would be part of an inner loop system.

UPGRADES

Mill Pond Road	US 701 Business to NC 130	Upgrade
Slippery Log Rd.	US 701 to SR 1437 (Pine Log Rd.)	Upgrade
SR 1436	Pinelog Road to Planning Boundary	Resurface

These facilities are below roadway design standards. They should be brought up to design standards through widening an additional 1.2 meters, 0.6 meters in each direction (4 ft., 2 ft.).

PUBLIC INVOLVEMENT

There are many steps in the development of a thoroughfare plan. There are also many people involved with its development. After an abundance of data is collected and deficiencies in the highway system are determined; a solution must be decided upon. The solution is worked out through a series of meetings with the local government, citizens, and NCDOT. This section presents the sequence of meetings leading to the adoption of the Whiteville/Brunswick Urban Area Thoroughfare Plan. NCDOT staff is present for the majority of this meetings.

1) August 30, 1994 --- Initial Meeting with Jeff Emory, Whiteville City Manager

The primary responsibility of the Statewide Planning Branch to assist the local area and to create an efficient, cost-effective plan for the improvement of an urban area's road system to meet future needs was discussed. The objectives and development of a thoroughfare plan was provided in a brochure.

A timetable we hoped to follow in developing the thoroughfare plan was presented. The scheduling of a meeting with the City Planning Board was requested. This meeting would explain the thoroughfare planning process to them and get their opinion of Whiteville's traffic needs and future growth. Next, an informal one-on-one workshop would be scheduled to inform the general public of the purpose of the study.

A traffic analysis of the area would be conducted, and then our findings and preliminary recommendations would be presented to city officials. The city officials can express their likes, dislikes, suggests, complaints, additions, etc., at this time or at any time during the process. After the City approves, a formal public hearing will be scheduled. The Proposed Recommended Thoroughfare Plan would be laid out for the public's viewing and recorded comments. The thoroughfare plan will be offered to the City Council for official adoption as the Recommended Thoroughfare Plan, after any revisions. The final step is mutual adoption of the plan by the North Carolina Board of Transportation.

2) October 3, 1994 --- Initial Meeting with Mayor Bennett William, Town of Brunswick

The primary responsibility of the Statewide Planning Branch and a timetable we hoped to follow in developing the thoroughfare plan was presented like above to Whiteville. During our discussion, we solicited comments on Brunswick's current traffic needs, and the areas where future growth is expected.

3) October 3, 1994 --- Meeting with the Whiteville Planning Board

The basic concepts of the thoroughfare plan were discussed. The meeting helped identify the areas of future growth in the Whiteville area, including the proposed industrial park near

Southeastern Community College and the continuing commercialization of US 701 Hwy.

The next step in the process, scheduling of the first public forum, was announced. This informal gathering will inform the general public of the purpose of the thoroughfare study and solicit their comments.

4) October 25, 1994 --- Public Forum

The two major purposes of this forum were to inform the public about the basic concepts of thoroughfare planning, and to solicit their opinions of the area's traffic needs. Comments are listed below.

1. The turnout was small, and most were city/town officials. There was coverage by Mitch Kokai, News Director of WENC radio and Leslie High, reporter for the News Reporter.

2. The primary current traffic problem is the intersection of US 701 Byp. & US 701 Bus. & NC 130 & the shopping center egress. A lack of positive guidance and signalization have resulted in a large number of accidents, including fatalities.

3. A sight distance problem exists on the US 701 Byp. bridge south of Virgil St. Northbound vehicles approaching signalized intersection cannot see stopped vehicles until they crest the bridge, which is dangerously close to the intersection. Presently, there are no guardrails on bridge approach.

4. The intersection of US 701 Bus. & SR 1916 & SR 1953 is congested and confuses drivers. Location needs phasing and/or geometric improvements.

5. High accident location at intersection of US 701 Byp. & US 74/76 Bus.

6. Traffic signal possibly warranted at intersection of NC 130 & SR 1170.

7. Left turn lanes are needed on US 701 Bus.

8. Driver confusion exists on US 74/76 Byp. west of area where highway tapers from four-lane divided section to two-lane section.

9. The extension of SR 1953 to SR 1920 was mentioned.

10. Thompson St. may be a collector from Lewis St. to US 74/76 Bus.

11. A golf course may be built off of NC 130 south of Brunswick.

12. The frequency of litter pick up along US 74/76 is not sufficient.

5) April 23, 1996 --- Meeting with George Kennan, City of Whiteville
May 10, 1996 ---- Meeting with Randy Williams, Town of Brunswick

Presented the capacity deficiency analysis of the plan along with some brainstorming ideas for the new plan to the city/town staff. A comparison of the old plan and possibilities in the new plan was discussed. Received feedback on the proposals.

6) May 14, 1996 --- Meeting with the Whiteville City Council
May 20, 1996 --- Meeting with the Brunswick Town Council

The basic concepts of the thoroughfare plan were discussed. Information and data collected from staff, field survey, and research on population, traffic, environmental concerns, land uses, economics, etc. were presented. The capacity analysis of the study with proposals for the new plan was laid out. A comparison of the old plan and deletions in the old plan were discussed. Received feedback on the proposals. The main concern was the one-way pair Franklin Street extension which has been on the thoroughfare plan since the 1960's, but now is surrounded by an upper class neighborhood.

7) June 11, 1996 --- Advertised Public Hearing

Presented the Recommended Thoroughfare Plan on map dated June 10, 1996 at the Whiteville City Council meeting. Explained each thoroughfare plan improvement. The town clerk represented the Town of Brunswick. There were comments concerning the Franklin Street extension and one-way pair from the Whiteville City Council, but no comments from the public.

8) July 9, 1996 --- Whiteville City Council Meeting

The City of Whiteville adopted the proposed Thoroughfare Plan dated June 10, 1996 with the provision that the one-way pair be eliminated.

9) July 15, 1996 --- Brunswick Town Council Meeting

The Town of Brunswick adopted the proposed Thoroughfare Plan dated June 10, 1996 as shown.

10) August 19, 1996 --- Brunswick Town Council Meeting
August 27, 1996 --- Whiteville City Council Meeting

The Town of Brunswick adopted the revised proposed Thoroughfare Plan dated August 5, 1996. The City of Whiteville adopted the revised proposed Thoroughfare Plan dated August 5, 1996. The revised proposed Thoroughfare Plan dated August 5, 1996 excludes the one-way pair. The Plan dated August 5, 1996 is to assure clarity in the intended actions of the respective councils.

4. EXISTING CONDITIONS

There are several major factors which must be considered in analyzing an existing highway system for future travel. They include population, employment, land use, traffic and environmental concerns. These factors control the type of thoroughfare plan an area needs. The more population there is, for example, the more traffic on the highway; or the more desirable the land, the more newcomers are attracted to the area, thus more traffic. The most important part in a study is making growth forecasts from existing conditions and converting them into future travel. This chapter will take a look into the existing conditions in the Whiteville/Brunswick Urban Area. Appendix B includes details of the Traffic Model Development for existing and future conditions.

POPULATION

Travel is directly related to population. The volume of traffic on a section of roadway is a function of the size and location of the population it serves. An analysis of the population is one of the first steps in planning a highway system. Although the City of Whiteville is the county seat, population growth for the urban area and county since the 1970's has been stagnate compared to the State. However population projections for the urban area is at a more moderate rate, because the area's officials are pushing strongly for more economic development.

Table 1 - Population Projections

Year	North Carolina	Columbus County	City of Whiteville	Town of Brunswick	Urban Area
1970	5,084,411	46,937	4,195	206	8,329
1980	5,880,415	51,037	5,565	223	8,833
1990	6,628,637	49,587	5,078	302	8,726
1994	7,070,034	50,084	5,690	310	9,978
2020	8,776,538	65,205	7,587	413	12,402

EMPLOYMENT

An area's economic base is a very important factor. This encourages an active highway system. An area's economic base is affected by how efficiently the street system handles traffic.

Economic growth suffers when an inadequate system causes congestion and delay. The Whiteville/Brunswick Urban Area has a good economic base although the median income for Columbus County is low. The area has relatively lower-paying service jobs than other areas in the State. The employment to population ratio is 45%. The median income for the county in 1994 is $26,300.

The largest employers in the Whiteville/Brunswick Urban Area are industrial businesses. The industrial businesses consists of textiles, banking, and lumber. The industrial category consists of the majority of the employment in the area.

LAND USE

The generation of traffic on a particular street is very closely related to the utilization of adjacent land areas. Some types of land uses generate much more traffic than others. For example, a commercial or retail area such as a shopping center would generate or attract much larger volumes of traffic than a residential area. The attraction between different land uses varies with the intensity of the development and the distance between those developed areas. Therefore, it becomes necessary to designate land uses by type for transportation planning. An analysis of the distribution of existing land uses serves as a basis for forecasting future land use needs and the resulting travel patterns.

The Whiteville/Brunswick Urban Area is mostly comprised of agricultural and residential land uses. The residential land uses are mostly located inside the city and town limits of Whiteville and Brunswick. Residential growth in the urban area is in the northern section, while commercial growth is mostly in the southern section and along major traffic routes.

TRAFFIC

Travel Demand

Travel Demand is generally reported in the form of average daily traffic counts. Traffic counts are taken at several locations in urban area by the North Carolina Department of Transportation yearly to estimate future travel demands. Traffic trends over the past thirty-four years are studied and projected based on expected land development in this study.

A comparison of annual growth rates from 1960 to 1994 at various count stations in the urban area showed average annual growth rates from 1.2% to 23.1%. The largest growth was on SR 1429 (Slippery Log Road) in the southwestern section of the planning area. There was an overall increase at the count stations. Appendix B gives existing and expected average traffic volumes based on similar trends.

Existing Road Network

A good indication of the adequacy of the existing road network is a comparison of traffic volumes with the ability of the streets to move traffic. In an urban area, a street's ability to move

TIDBITS

PROFILE

Whiteville is the largest city in the county and the county seat for Columbus County. Whiteville was chartered in 1833.

The Town of Brunswick is one of the smallest towns in the county and lies on the outskirts of Whiteville.

POPULATION

Year	County	Whiteville	Brunswick
1993	50,198	5,513	299
1994	50,084	5,690	310
2020	65,200	7,587*	413*

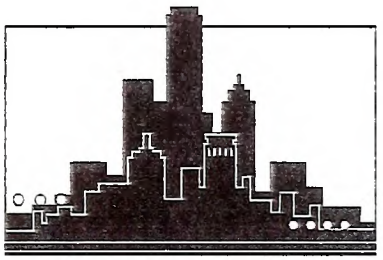
*Statewide Planning Projections

LOCATION

Whiteville is in close proximity to Wilmington and Myrtle Beach about 45 minutes.

It is also 10 minutes away from the State's Largest Natural Lake, Lake Waccamaw.

*Internet



HIGHLIGHTS

- The Honorable Mayor Horace Whitley has been serving as Whiteville's mayor since 1965.
- The Columbus County Courthouse is listed in the National Register of Historic Places. This past year it was filmed as part of a major motion picture.
- The area receives a 1-2 punch of powerful hurricanes. Hurricane Bertha and Hurricane Fran hit the area within two months of each other. The eye of Hurricane Fran passes over the county leaving an estimated $5 Billion in damages for North Carolina after Hurricane Bertha came through leaving over $210 million in damages for North Carolina . *Internet www.ncdc.gov

SPORTS

Whiteville has an abundance of athletes receiving National recognition. Just to name a few. There is Chester McGlockton who presently plays with the Los Angeles Raiders, Otis Nixon with the Toronto Blue Jays, and Margaret Will who plays professional Golf.

**The News Reporter Centennial Edition*

EMPLOYMENT

Brunswick is home to the County's Top Five Largest Employer, National Spinning Co.

Other Top Five Employers in Whiteville are Federal Paper Board, Whiteville Apparel, Anvil Knitwear, and United Carolina Bank.

**North Carolina*, Oct. 95

EDUCATION

Southeastern Community College has given 30 years of Excellence. It is highly acclaimed for it's nursing, computer, and forestry programs. *Internet

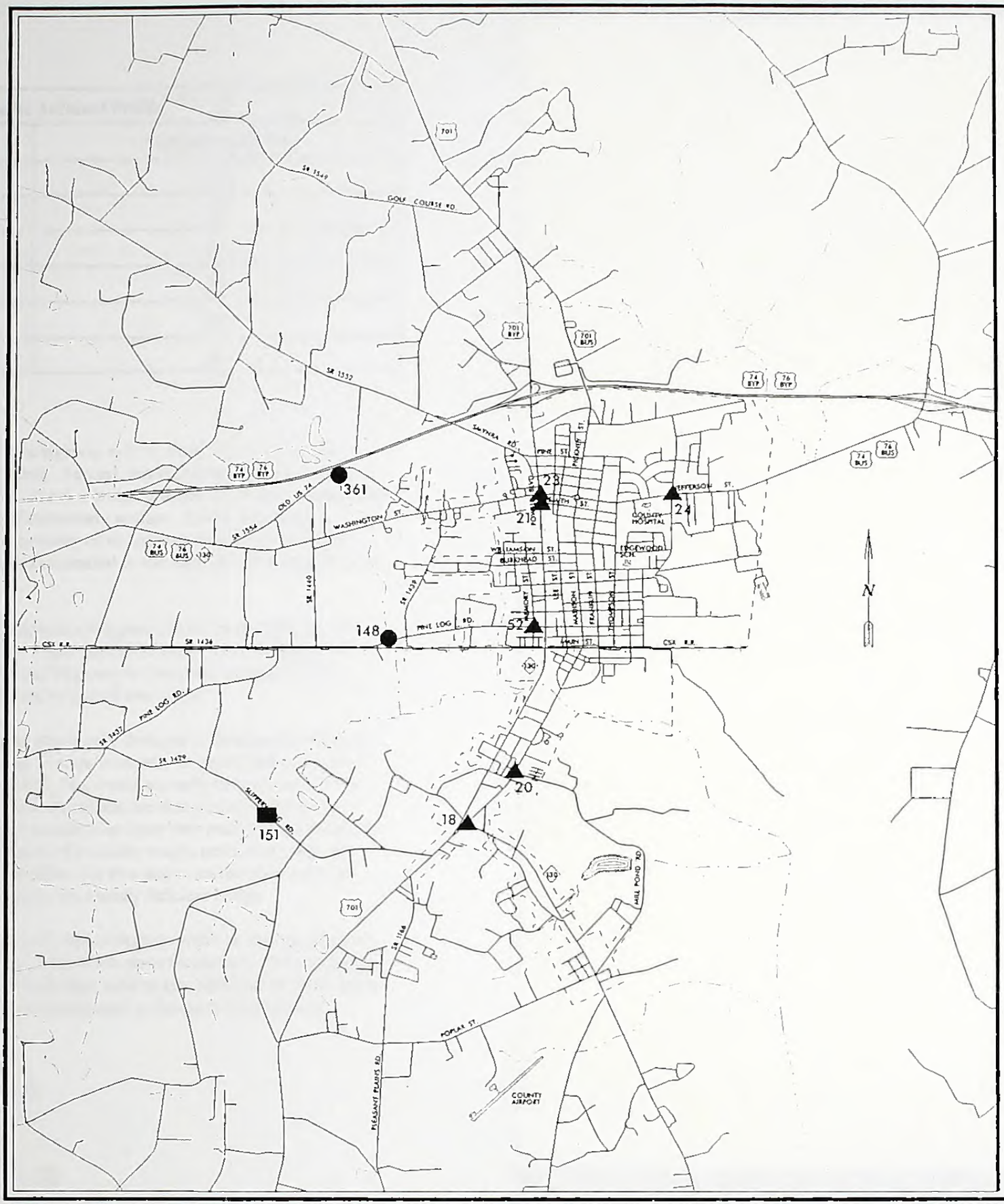
traffic is generally controlled by the spacing of major intersections, the width of pavement, and the traffic control devices utilized. Thus, the ability of a street to move traffic can be increased to some degree by restricting parking and turning movements; using proper sign and signals devices; and by the application of other traffic engineering techniques. Capacity is defined as the maximum number of vehicles which has a reasonable expectation of passing over a given section of a roadway in one direction, or in both directions, during a given time period under prevailing roadway and traffic conditions. The relationship of traffic volumes to the capacity of the roadway will determine the level of service being provided. Six levels of service have been selected to identify the conditions existing under various speed and volume conditions on any highway or street (See Appendix D). The level of service usually suitable for urban design practice is level of service C and is defined as being in the zone of stable flow with most drivers restricted in their freedom to select their own speed, change lanes, or pass (usually new roads). A relatively satisfactory operating speed is attained at this level of service. Thoroughfare plan improvements are generally designed to the level of service D.

The Whiteville/Brunswick central area is characterized by a gridiron pattern. The other areas are served by radial streets. The existing road network has three main facilities which go through the urban area. They are US 74/76 Bypass, US 701 Bypass, and NC 130. US 701 Bypass and NC 130 experience heavy through traffic during the summer season from beach goers. The majority of the facilities in the urban area function adequately in moving traffic with the exception of US 701 Business downtown. The lack of crosstown facilities connecting in a loop system is the only road network deficiency.

Traffic Safety

Traffic accident analysis is a serious and important consideration in thoroughfare plan development. The source of traffic accidents can be broken down into three general categories. The first is the physical environment which includes such things as road condition, weather, road obstructions, and traffic conditions. The second source is associated with the driver. This includes the driver's mental alertness, distractions in the car, ability to handle the vehicle, and reaction time. The third source is the physical attributes of the vehicle. This includes such things as the condition of the brakes and tires, vehicle responsiveness, size of the vehicle, and how well the windshield wipers and defroster work. All traffic accidents can be attributed to one or more of these sources; however, the driver is often the primary source.

Traffic accident records assist in defining deficient areas in the highway system. It is a good indicator of where the highway system breaks down. Accident patterns, revealed in accident data, are effective in the improvement decisions of a highway system. The traffic accident data received for the urban area had certain criteria. They were (1) accidents documented between January 1991 and December 1993; (2) accidents occurring a minimum of 200 feet from the intersection; and (3) a minimum of fifteen accidents at an intersection. See Figure #4 for Traffic Accident Profile locations.



BRIDGE & ACCIDENT DATA

LEGEND

- ● STRUCTURALLY DEFICIENT
- ■ FUNCTIONALLY OBSOLETE
- ▲ ACCIDENT LOCATION

FIGURE 4

WHITEVILLE /BRUNSWICK URBAN AREA

COLUMBUS COUNTY
NORTH CAROLINA

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS-STATEWIDE PLANNING BRANCH

U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION

Base map date
DECEMBER 1994

Table 2 - Traffic Accident Profile	
INTERSECTION	# OF ACCIDENTS
US 701 Bypass & Virgil Street	52
Jefferson Street & Old Tram Road	24
US 701 Bypass & Washington Street	23
US 701 Bypass & Smith Street	21
Mill Pond Road & US 701 Business	20
NC 130 & US 701 Business	18

Bridge Conditions

Bridges are a vital and unique element of a highway system. First, they represent the highest unit investment of all elements of the system. Second, any inadequacy or deficiency in a bridge reduces the value of the total investment. Third, a bridge presents the greatest opportunity of all potential highway failures for disruption of community welfare. Finally, and most importantly, a bridge represents the greatest opportunity of all highway failures for loss of life. For these reasons, it is imperative that bridges be constructed to the same design standards as the system of which they are a part.

Congress enacted the National Bridge Inspection Program Standards on April 27, 1971, implementing the Federal Highway Act of 1968. These standards require that "all structures defined as bridges located on any of the Federal-Aid Highway be inspected and the safe load carrying capacity computed at regular intervals, not to exceed two years."

Deficient bridges are categorized as either structurally deficient or functionally obsolete. **Structural deficiency** does not always mean that a bridge is unsafe. It usually indicates that a bridge is unable to handle the vehicle loads or speeds that would normally be expected on the highway system where the bridge is located. These limitations are then posted at the bridge approach. Structural deficiencies are particularly troublesome since they must be load posted for safety's sake. Although load posting (the imposition of a vehicle weight restriction), typically does not affect auto and light truck users, it does affect trip time and costs for other types of trucks that are required to detour in order to avoid a structurally deficient bridge.

A bridge that is **functionally obsolete** usually has inadequate width or vertical clearance for its associated highway system. In some cases, bridges are made functionally obsolete because of highway improvements on the approaches to the bridge, such as lane additions or widening of approaching roads. In other cases, bridges may be reevaluated as functionally obsolete if

engineering standards have changed. Functionally obsolete bridges restrict the efficient use of the system because they act as bottlenecks.

The North Carolina DOT's Bridge Maintenance Unit, with assistance from various consultants, inspects all bridges on the State Highway System. All bridges in the Whiteville/Brunswick Urban Area have been analyzed, rated, appraised, and inventoried, and the resulting data has been reduced to a more readily useable form as a management tool. A sufficiency index number has been calculated for each bridge to establish eligibility and priority for replacement. The bridges with the highest priority are replaced as Federal-Aid funds and State funds are made available.

The sufficiency rating is a method of evaluating deficiency factors that determine whether a bridge is sufficient to remain in service. The result of this method is a percentage in which 100 percent represents an entirely sufficient bridge and zero percent represents an entirely insufficient or deficient bridge. A sufficiency rating of 50 percent or less qualifies for Federal Bridge Replacement Funds.

The Whiteville/Brunswick Urban Area has only three deficient bridges below the sufficiency rating of 50%. They cross Cedar Branch and Pine Log Branch. The bridge located on SR 1429 (Slippery Log Road) is the most insufficient of the three bridges. The bridge sufficiency chart is below, also see Figure #4. Bridge #151 and Bridge #361 are included in the 1997-2003 Transportation Improvement Program under project B-3146 & B-3147, respectively.

Table 3 - Bridge Sufficiency Chart

Bridge #	Type	Percent Rating	Location	Stream Crossing
148	SD	24.6	SR 1437	Pine Log Swamp
151	FO	49.9	SR 1429	Cedar Branch
361	SD	35.8	SR 1554	Pine Log Swamp

SD = Structurally Deficient FO = Functionally Obsolete

ENVIRONMENTAL CONCERNS

Thoroughfare Planning is the planning of highway systems. It is also the initial stage of a road being constructed. Environmental factors have been a consideration in planning by North Carolina since 1959. The environmental factors are (1) physical environment; (2) social and cultural environment; and (3) economic environment. See Table 4 below. Although all of these factors were addressed in the study, only some of the factors will be discussed here.

Environmental considerations in planning include (1) identifying critical environmental factors; (2) developing alternatives based on environmental factors; (3) evaluating alternatives relative to travel service and environmental factors; and (4) developing a recommended thoroughfare plan that best meets environmental, travel service and other public goals. Even before evaluating alternatives certain environmental data is gathered. For instance, wetlands inventory , historic landmarks, economic development, etc. are gathered. Early research into environmental factors is general. However, recommendations given in a thoroughfare plan will more likely remain intact if environmental factors are researched.

Table 4 - Environmental Factors

Physical	Social & Cultural	Economic
Air Quality, Water Quality, Wetlands, Soils & Geology, Wildlife & Vegetation	Housing & Neighborhoods, Educational Facilities, Churches, Historic Properties Recreational Facilities, Public Health & Safety, Aesthetics	Businesses, Economic Development, Public Utilities, Transportation Costs, Capital Cost, Operation & Maintenance Costs

Water Quality

Water Quality is a prime asset and every effort should be made during highway construction to adhere to recommended guidelines to prevent contamination. Guidelines for maintaining water quality include: (1) control of soil erosion and siltation; (2) control of waste disposal areas during construction; (3) allowing entrance of live and impounded waters only within construction limits; (4) no deposition of any construction materials or pollution agents in traversed waters; (5) proper drainage of all borrow pits and ditches; and (6) inclusion of adequate drainage control plans on facilities in construction. These guidelines are set in NCDOT's "Best Management Practices for Protection of Surface Waters".

Waste sites is also a concern to water quality. Waste sites are waste from leaking underground tanks and sewage disposal. There are different categories of waste sites. A description of the three main categories are as follows: 1) Superfund Sites are critical. It is major hazardous waste from mostly leaking underground tanks. 2) Groundwater Incidents are also mostly leaking underground tanks. However they are not as critical as Superfund sites. 3) National Pollution Discharge Elimination Systems, NPDES, are sewage discharge out falls from some type of industry. The Whiteville/Brunswick Urban Area has eleven waste sites, Superfund and NPDES sites. The Superfund sites are Georgia Pacific, four sites; Lackey Industries Warehouse; and USS AgriChemical Farm Service Center. The NPDES sites are located at the Georgia Pacific Corp./Whiteville Timber facility; National Spinning Company, two sites; City of Whiteville/White Marsh Waste Water Treatment Plant; and the International Branded Apparel.

Wetlands

Wetlands are very important in evaluating alternatives. Wetlands are lands where saturation with water is the dominant factor in determining the nature of soil development and the types of plant and animal communities living in the soil and on its surface. The Wetlands Memorandum of Agreement Section 404 of the Clean Water Act of 1977 gives guidance on this environmental factor. The primary goal of the memorandum is to achieve no net loss of wetlands. Also, no disruption of wetlands is permitted, if there is a practical and feasible alternative that would have less adverse impact on the area. In addition, compensatory mitigation is required if wetlands are impacted.

The Whiteville/Brunswick Urban Area is bounded on the east side by the enormous White Marsh Swamp. White Marsh is identified as a Priority area with the State. Therefore any land use growth is on the west side of the urban area. White Marsh Swamp is not the only wetland in the urban area. Pine Log Swamp and Soules Swamp lie to the west of the Health Center Road (SR 1439) and south of Main Street, respectively. These are mini swamps compared to the size of White Marsh. Only one new thoroughfare plan improvement impact one of the swamps, the US 701 widening. This widening will impact Soules Swamp.

Wildlife and Vegetation

In this rural urban area there is an abundance of wildlife and vegetation. However there is only one listed with the Endangered and Threatened Plants and Animals of North Carolina, the Alligator Mississippiensis, alligator. There is also a list of rare plants and animals. One animal included is the Procambarus Ancylus, a crayfish. The plants included are the Dionara Mu Scipula, venus flytrap; Peltandra Sagittoefolia, spoonfloor; Carex Crus-Corvi, crowfoot sedge; Cheilolejeunea Rigidula, A Liverwort; Lopholejeunea Muelleriana, A Liverwort; and Epidendrum Conopseum, orchid. No thoroughfare plan improvements impact any of the above.

Housing and Neighborhoods

The preservation of pleasant cohesive neighborhoods is a fundamental criteria of thoroughfare planning and an important goal for the Whiteville/Brunswick Urban Area. By designating certain streets as thoroughfares, heavy traffic is kept off neighborhood streets, and the negative impacts of traffic are segregated as much as possible from residential environment. Maintaining these conditions, as population and travel grows, requires improvements to the thoroughfare system . The one-way pair system with Madison Street and Franklin would have been designed to do just that if it was not deleted from the Plan. It would have reduced traffic on the residential streets with little disruption to existing neighborhoods. Much of the proposed construction from the Thoroughfare Plan is outside the developed urban area.

Educational Facilities

The urban area's school system is unique. All four public schools plus a private school are located inside the urban area. This factor promotes much parental and community interest and involvement in educating the children.

No schools will be displaced by the thoroughfare plan. However, the schools will be affected in a positive sense. The thoroughfare plan relieves congestion and operational problems near the Edgewood school zone at Old Tram Road.

Churches

No churches are affected by the thoroughfare plan.

Historical Properties

The Whiteville/Brunswick Urban Area contains one National Register property, the Columbus County Courthouse. There are also two properties on the State Study list, the Oscar High House and the Whiteville Depot. The Thoroughfare Plan does not affect these properties.

Public Health and Safety

The thoroughfare plan contributes to the public health and safety through (1) reduction in traffic accidents; (2) improved service to medical facilities; (3) improved mobility for fire, police and other emergency vehicles; and (4) enhanced air quality.

Implementation of the thoroughfare plan will provide greater mobility of public vehicles through the downtown area and around the heart of Whiteville. The Old Tram Road Connector provides a faster way for public vehicles to reach the Columbus County Hospital.

National Defense

A national defense highway serves transportation demands during periods of national or local emergency such as war and natural calamity. NC 130 is designated as a Hurricane Evacuation Route for the Coastal Beaches.

Businesses

The development of a thoroughfare plan has both positive and negative effects on business within the area. As new thoroughfares are constructed, or old ones widened, the improved mobility tends to improve the overall business climate and proves more attractive to the establishment of new business interests. The construction of new facilities often opens up new land areas for business expansion. On the negative side is the potential disruption or removal of existing businesses as a result of thoroughfare construction, although no businesses are anticipated on being removed in the Whiteville/Brunswick planning area.

Employment

Improvement in the level of service provided by the thoroughfare system will reduce transportation costs for industry, facilitate industrial employment expansion, and contribute to area income through additional business activity and reduced transportation cost for workers. An adequate thoroughfare plan will improve the future economic vitality of the Whiteville/Brunswick Urban Area.

Economic Development

New thoroughfares that open new areas for development will most influence this factor. New industry prefers good access that provides easy mobility into and out of the industrial area. A project can stimulate economic development in the immediate area and in adjacent areas. The Health Center Road (SR 1439) and the Old Tram Road Connector would be examples.

5. ADMINISTRATIVE CONTROLS AND IMPLEMENTATION TOOLS

State and Municipal
Adoption of the Thoroughfare Plan

Chapter 136, Article 3A, Section 136-66.2 of the General Statutes of North Carolina provides that after development of a thoroughfare plan, the plan may be adopted by the governing body of the municipality and the Department of Transportation to serve as the basis for future street and highway improvements. The General Statutes also require that, as part of the plan, the governing body of the municipality and Department of Transportation shall reach agreement on responsibilities for existing and proposed streets and highways included in the plan. Facilities which are designated a State responsibility will be constructed and maintained by the Division of Highways. Facilities which are designated a municipal responsibility will be constructed and maintained by the municipality.

After mutual plan adoption, the Department of Transportation will initiate negotiations leading to determining which of the existing and proposed thoroughfares will be a Department responsibility and which will be a municipal responsibility. Chapter 136, Article 3A, Section 136-66.1 of the General Statutes provides guidance in the delineation of responsibilities. In summary, these statutes provide that the Department of Transportation shall be responsible for those facilities that serve volumes of through traffic and traffic from outside the area to major business, industrial, governmental, and institutional destinations located inside the municipality. The municipality is responsible for those facilities that serve primarily internal travel.

In areas over 50,000 population, Federal Law requires adoption by the Metropolitan Planning Organization. In North Carolina this is accomplished through the Transportation Advisory Committee (TAC) for that urbanized area. This body is made up of local elected officials and a representative from the North Carolina Board of Transportation. The Whiteville/Brunswick area does not fall under this provision.

Unless implementation is an integral part of the transportation planning process, the effort and expense associated with developing a plan is lost. To neglect the implementation process is a three-fold loss; the loss of the capital expenditures used in developing a plan, the opportunity cost of the capital expenditures, and more importantly the loss of the benefits that would accrue from an improved transportation system.

Administrative controls and implementation tools that can aid in the implementation process are generally available to municipalities through Federal and State Legislation. These controls and

tools will be discussed in this chapter. They include: Subdivision Regulations, Zoning Ordinances, Official Maps, Urban Renewal, Capital Improvements Programs, and Development Reviews.

Generally two issues play a major role in the implementation process, available finances and citizen involvement. Effective use of the controls and tools listed above are indicative of good planning and minimize the effects of limited finances and negative citizen reaction to specific elements of a plan. It is through good planning that maximum use is made of every available dollar and that citizen involvement and approval of the transportation plan is obtained.

Subdivision Regulations

Subdivision regulations are locally adopted laws governing the process of converting raw land into building sites. From the planner's view, subdivision regulations are important at two distinct levels. First, they enable the planner to coordinate the otherwise unrelated plans of many individual developers. This process assures that provision is made for land development elements such as roadway right-of-way, parks, school sites, water lines, sewer outfalls, and so forth. Second, they enable the planner to control the internal design of each new subdivision so that its pattern of streets, lots, and other facilities will be safe, pleasant, and economical to maintain.

To be most effective, subdivision regulations and their administration must be closely coordinated with other local governmental policies and ordinances. Among the more important of these are the Comprehensive Growth Plan, Utilities Extension Master Plan, CAMA Land Use Plan, and Thoroughfare Plan.

In practice, subdivision regulations can provide some very positive benefits such as requiring portions of major streets to be constructed in accordance with the Thoroughfare Plan, or requiring subdividers to provide for the dedication and/or reservation of rights-of-way in advance of construction. These practices reduce the overall cost of the plan by having some costs borne by developers. Recommended Subdivision Ordinances are included in Appendix D.

* *The long range Western Bypass, Health Center Road extension, Old Tram Road connector and the Lewis Street extension could benefit from developer cooperation through subdivision regulations*

Zoning Ordinances

Zoning is probably the single most commonly used legal device available for implementing a community's land-use plan. To paraphrase the U.S. Department of Commerce 1924 Standard Zoning Enabling Act, on which most present-day legislation is based, zoning may be defined as the

division of a municipality (or other governmental unit) into districts, and the regulation within the districts of:

1. the height and bulk of buildings and other structures,
2. the area of a lot that may be occupied and the size of required open spaces,
3. the density of population, and
4. the use of buildings and land for trade, industry, residence, or other purposes.

The characteristic feature of the zoning ordinance that distinguishes it from most other regulations is that it differs from district to district, rather than being uniform throughout a city. Thus, a given area might be restricted to single-family residential development with minimum lot size requirements and setback provisions appropriate for development. In other areas, commercial or industrial development might be permitted, and regulations would be enacted to control such development. Building code provisions or sanitary regulations, on the other hand, normally apply to all buildings in a certain category regardless of where they may be situated within a city.

The zoning ordinance does not regulate the design of streets, utility installation, the reservation or dedication of parks, street rights-of-way, school sites, and related matters. These are controlled by subdivision regulations or possibly by use of an official map. The zoning ordinance should however, be carefully coordinated with these and other control devices.

Official Maps

The roadway corridor official map (or official map) is a document, adopted by the legislative body of the community or the North Carolina Board of Transportation, that pinpoints and preserves the location of proposed streets against encroachment. In effect, the official map serves notice on developers that the State or municipality intends to acquire specific property. The official map serves as a positive influence for sound development by reserving sites for public improvements in anticipation of actual need.

Official maps place restrictions on private property. These restrictions are in the form of a prohibition, for up to three years, on the issuance of building permits or the approval of subdivisions on property lying within an official map alignment. The three year reservation period begins when a request for development is denied. This authority should be used carefully and only in cases where less restrictive powers are found to be ineffective.

* *The long range Western Bypass could be a candidate for having an official map developed by the local area.*

Requests for NCDOT to prepare and adopt an official map should be sent to the Director of Planning and Programming. For cities contemplating the adoption of an official map, there are two ways in which the city may proceed. The first is to consider the official map statute as a

stand-alone authority and use it as the basis for local adoption of an official map. Alternatively, the second approach is to adopt a local ordinance modeled after the statute, but modified to fit local circumstances and clarify the statute. Regardless of the approach taken, several procedural steps will need to be considered, such as establishing procedures for consideration of variance petitions.

Once the project has been selected and the alignment determined, maps must be prepared that are suitable for filing with the County Register of Deeds Office. The map should show the proposed alignment in sufficient detail to identify the functional design and the preliminary right-of-way boundaries. Since the purpose of the map is to show the effect on properties along the project path, the existing property boundaries should be identified. As an additional requirement, within one year of the adoption of an official map, work must begin on an environmental document or preliminary engineering.

It is important to recognize the risks inherent in the adoption of an official map prior to completing the environmental studies. Projects to be funded using any federal funds require the unbiased evaluation of alternate alignments. This means that other alternatives can be studied and compared to the protected alignment.[1]

The above information is only to serve as an introduction to official maps, and in no way provides the information necessary to begin development of an official map. Requests for maps or guidance for municipal adoption should be sent to:

The Director of Planning and Programming
NC Department of Transportation
P.O. Box 25201
Raleigh, North Carolina 27611

Urban renewal

Urban renewal plays a minor role in the transportation planning implementation process in terms of scope and general influence. However, under the right circumstances, renewal programs can make significant contributions. Provisions of the New Housing Act of 1974 (as amended) call for the conservation of good areas, rehabilitation of declining areas, and clearance of deteriorating areas.

In the course of renewal, it is important to coordinate with the Thoroughfare Plan to see if additional set-back or dedication of right-of-way is needed. Continued use of the urban renewal programs to improve the transportation system is encouraged. Changes that can be made under this

[1] "Guidelines for Municipalities Considering Adoption of Roadway Corridor Official Maps," prepared by NCDOT Program, Policy and Budget Branch.

program are generally not controversial or disruptive given the trauma of the clearance of a significant area.

* *The Health Center Road extension, Old Tram Road connector, and the Lewis Street extension could be affected by urban renewal projects.*

Capital Improvement Programs

Capital programs are simply the coordination of planning and money. The capital improvements program, with respect to transportation, is a long range plan for the spending of money on street improvements, acquisition of rights-of-way and other improvements within the bounds of projected revenues. Municipal funds should be available for construction of street improvements which are a municipal responsibility; right-of-way cost sharing on facilities designated a Division of Highways responsibility; and advance purchase of right-of-way where such action is warranted.

Historically, cities and towns have depended, to a great degree, on Federal or State funding to solve their transportation problems. Chapter 136-Article 3A of the Road and Highway Laws of North Carolina clearly outlines the responsibilities and obligations of the various governmental bodies regarding highway improvements. North Carolina Highway Bill 1211, passed in 1988, limits the role of municipalities in right-of-way cost sharing for projects once they are programed in the NCDOT Transportation Improvement Program. Set-back regulations, right-of-way dedications and reservations play a major role in the ultimate cost of many facilities. Only in special cases will the municipality be able to enjoy the benefits of highway improvements without some form of investment.

Development Reviews

Driveway access to a State maintained street or highway is reviewed by the District Engineer's office and by the Traffic Engineering Branch of the North Carolina Department of Transportation prior to access being allowed. Any development expected to generate large volumes of traffic (ie., shopping centers, fast food restaurants, large industries, etc.) may be comprehensively studied by staff from the Traffic Engineering Branch, Statewide Planning Branch, and Roadway Design Branch of NCDOT. If done at an early stage, it is often possible to significantly improve the development's accessibility at minimal expense. Since the municipality is the first point of contact for developers, it is important that the municipality advise them of this review requirement and cooperate in the review process.

Other Funding Sources

1. Assess user impact fees to fund transportation projects. These fees, called "facility fees" in the

legislation, are to be based upon "reasonable and uniform considerations of capital costs to be incurred by the city or town as a result of new construction. The facility fee must bear a direct relationship to additional or expanded public capital costs of the community service facilities to be rendered for the inhabitants, occupants of the new construction, or those associated with the development process."

2. Enact a bond issue to fund street improvements.

3. Continue to work with NCDOT to have local projects included in the Transportation Improvement Program (TIP).

* *Local projects would include the long range Western Bypass and the Franklin Street extension.*

4. Consider the possibility of specific projects qualifying for federal demonstration project funds.

5. Adopt a collector street plan that would assess buyer or property owners for street improvement.

Project Development

Once a project is identified on the mutually adopted Thoroughfare Plan, the next step for projects anticipated to be implemented with State and Federal Funds is for the municipality to present it as a request at the North Carolina Board of Transportation Public Hearings for updating the Transportation Improvement Program. The Transportation Improvement Program (TIP) is a seven-year programming document that lists all transportation projects which NCDOT anticipates spending funds on during the designated time period.

Every year the TIP is updated by the Board of Transportation. As part of the updating process, public hearings are held throughout the State. Representatives from Counties and Municipalities attend the public hearing in their area and present their "request lists." This list is compiled from the recommendations contained within their Thoroughfare Plan. After all the public hearings have been held, the Board of Transportation convenes to deliberate the merits and costs of all the requested projects. Since the TIP is a financially constrained document, the total costs of all the projects must not exceed expected revenues over the seven-year period. Therefore, not all requested projects can be included in the TIP.

Figure 5 shows a flowchart detailing the annual process for updating the TIP. As can be seen from the chart, the public hearings are held in the Fall. To obtain information on the date and location of the public hearing for your area, call the NCDOT Program Development Branch at (919) 733-2039. In areas designated by the U.S. Census Bureau as urbanized, that is 50,000 or

greater population, there is an additional process. In these areas, the Transportation Advisory Committee compiles the list of transportation priorities every year. This list is then advertised for public review and comment. The Transportation Advisory Committee discusses the public input and consequently adopts a formal transportation priorities list to be presented at the Board of Transportation Public Hearing for the entire urban area.

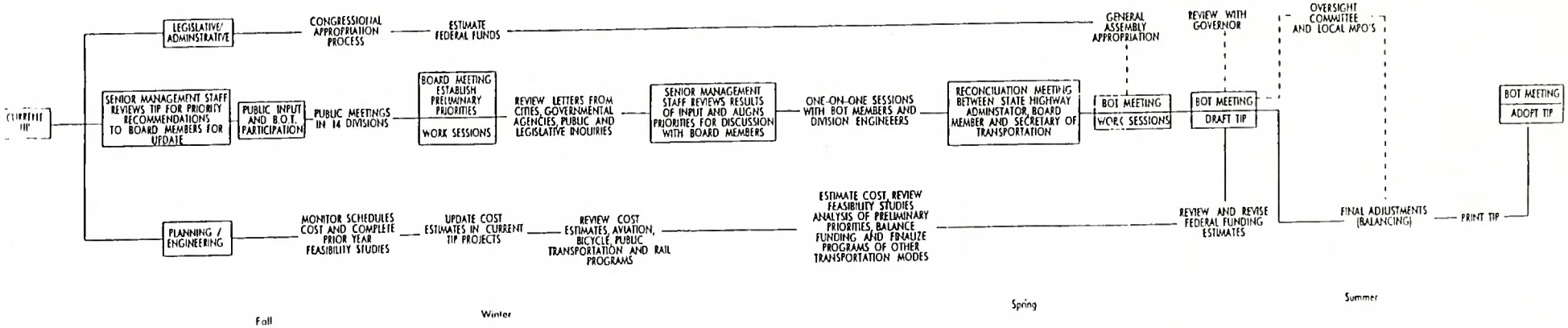
For transportation projects anticipated to be implemented with local funds, the project will need to be programmed into the Capital Improvements Program (CIP). If there is not a CIP, then the project needs to be addressed by the governing body (City\Town Council or County Commission).

Once a project actually gets programmed into the TIP, an environmental analysis is performed. This would involve studying two or more alternatives with regard to wetlands, air quality, noise, archeaology, historic structures, threatened and endangered species, water quality, socioeconomic factors, neighborhood cohesion, hazardous waste, and wildlife habitat. The degree of impact on these factors is then detailed in an environmental document.

After the environmental study, a preferred alternative is selected and a final environmental document produced. Then a preliminary design is completed for the selected alternative. During the course of project development, one or more public hearings will be held to obtain public input on the alternative selected and the design of the project. Once issues raised by other governmental agencies and the public have been addressed, the final design is completed. The project then goes on to right-of-way acquistion, contract letting, construction, and finally open to the public.

FIGURE 5

ANNUAL PROCESS OF UPDATING THE TIP



APPENDIX A

STREET INVENTORY

[METRIC UNITS]

FACILITY AND SECTION	EXISTING CONDITIONS: DIST. (km.)	SPEED (km/h)	ROW (m.)	# OF LANES	PVMT. (m.)	PVD. SHLD. (m.)	C&G	PARK.	# STOP LIGHTS	# STOP SIGNS	PRACTICAL CAPACITY LOS D	1994 ADT	2020* ADT	RECOMMENDED X-SECTION	RECOMMENDED ROW
US 74-76 BYPASS															
(SR 1585 to SR 1552/Smyrno Rd.)	4.0	88	60	4	15	5	N	N	0	0	49,400	9,400	16,600	ADQ	ADQ
(SR 1552 to White Marsh Bridge)	4.0	88	60	4	15	5	N	N	0	0	49,400	7,300	13,900	ADQ	ADQ
US 74-76 BUSINESS															
(White Marsh Bridge to 0.2 mi east Columbus Apparel St.)	0.6	88	27	2	8		N	N	0	0	16,200	8,600	16,300	ADQ	ADQ
(0.2 mi east Columbus Apparel St. to Thompson St.)	1.8	72	20	4	16		L/R	N	2	0	30,800	8,600	16,300	ADQ	ADQ
(Thompson St. to SR 1953)	0.2	56	20	4	16		L/R	N	0	0	30,800	8,600	16,300	ADQ	ADQ
(SR 1953 to SR 1916)	0.5	32	18	2	13		L/R	L/R	1	0	14,300	10,500	18,000	G	ADQ
(SR 1916 to Grove St.)	0.6	56	18	2	13		L/R	N	1	0	14,300	9,000	15,500	G	ADQ
(Grove St. to SR 1554)	1.1	56	18	2	7		N	N	0	0	14,300	6,200	10,400	ADQ	ADQ
(SR 1554 to SR 1440)	1.3	72	18	2	7		N	N	0	0	13,000	6,200	10,400	ADQ	ADQ
(SR 1440 to SR 1585)	2.1	88	18	2	7		N	N	0	0	13,000	6,200	10,400	ADQ	ADQ
US 701															
(nbl to Jcn. US 701 Bus./Byp.)	1.9	88	60	2	10		N	N	0	0	14,100	9,900	21,350	C	ADQ
(Jcn. US 701 Bus./Byp. to US 74-76)	1.6	88	60	2	7	0	N	N	0	0	13,000	5,900	13,400	C	ADQ
(US 74-76 interchange)	0.3	88	30	4	14	2	N	N	0	0	28,000	14,200	27,700	ADQ	ADQ
(interchange to US 74-76 Bus.)	1.1	72	30	3	10	1	N	N	1	0	23,200	14,200	27,700	C	ADQ
(US 74-76 Bus. to W. Virgil St.)	1.6	72	30	5	13		L/R	N	1	0	28,000	14,200	27,700	ADQ	ADQ
(Virgil St. to Talbot St.)	1.0	88	60	2	7		N	N	0	0	13,000	13,400	25,500	C	ADQ
(Talbot St. to Hay St.)	1.3	88	60	3	10		N	N	0	0	23,200	13,400	25,500	C	ADQ
(Hay St. to Jcn. NC 130)	0.3	72	45	4	14		N	N	1	0	30,800	13,400	25,500	ADQ	ADQ
(Jcn. NC 130 to W'ville CL)	1.1	72	45	2	7		N	N	0	0	13,000	13,400	25,500	C	ADQ
(W'ville CL to SR 1170)	2.2	88	45	2	7		N	N	0	0	13,000	9,600	17,300	C	ADQ
US 701 BUSINESS															
(Jcn. NC 130 to SR 1953)	1.9	72	20	5	16		L/R	N	1	0	28,000	17,300	29,000	ADQ	ADQ
(SR 1953 to Pecan St.)	0.3	32	14	2	13		L/R	R	0	0	10,700	17,300	29,000	G	ADQ
(Pecan St. to Webster St.)	0.8	32	12	2	11		L/R	L/R	5	0	10,700	6,900	14,100	G	ADQ
(Webster St. to Jefferson St.)	1.0	56	12	2	11		L/R	L/R	0	0	10,700	6,900	14,100	G	ADQ
(Jefferson St. to Frink St.)	1.3	32	15	2	13		L/R	L/R	0	0	10,700	3,800	8,400	ADQ	ADQ
(Frink St. to Richardson St.)	1.0	56	18	2	11		L/R	N	0	0	14,100	3,800	8,400	ADQ	ADQ
(Richardson St. to SR 1705)	0.3	56	15	2	8		N	N	0	0	14,100	3,800	8,400	ADQ	ADQ

See Definition of Terms & Note on lost page

STREET INVENTORY

[METRIC UNITS]

FACILITY AND SECTION	EXISTING CONDITIONS: DIST. (km.)	SPEED (km/h)	ROW (m.)	# OF LANES	PVMT. (m.)	PVD. SHLD. (m.)	C&G	PARK.	# STOP LIGHTS	# STOP SIGNS	PRACTICAL CAPACITY LOS D	1994 ADT	2020* ADT	RECOMMENDED X-SECTION	RECOMMENDED ROW
US 701 BUSINESS															
(SR 1705 to Jcn. US 701)	0.6	88	18	2	7		N	N	0	0	13,000	3,800	8,400	ADQ	ADQ
NC 130															
(SR 1966 to SR 1171)	1.1	88	18	2	7		N	N	0	0	13,000	7,500	12,600	C	27
(SR 1171 to SR 1950)	0.6	58	18	2	13		L/R	N	0	0	14,100	7,500	12,600	C	27
(SR 1950 to Jcn. US 701 Byp.)	2.1	72	30	2	8	2	N	N	2	0	14,100	8,100	15,000	C	ADQ
SR 1166 [PLEASANT PLAINS RD.]															
(US 701 to SR 1170)	1.9	72	18	2	6		N	N	0	1	12,000	2,800	4,000	ADQ	ADQ
SR 1429 [SLIPPERY LOG RD.]															
(US 701 to SR 1434)	1.8	88	18	2	6		N	N	0	1	12,000	2,600	4,400	ADQ	ADQ
(SR 1434 to SR 1437)	2.6	88	18	2	6		N	N	0	1	12,000	2,700	6,000	ADQ	ADQ
SR 1437 [PINE LOG RD.]															
(West Planning Boundary to Baldwin Cr.)	4.6	88	18	2	6		N	N	0	1	12,000	600	1,500	ADQ	ADQ
(Baldwin Cr. to US 701)	1.0	58	15	2	5		L/R	N	1	0	12,000	4,300	10,500	ADQ	ADQ
SR 1439 [HEALTH CENTER RD.]															
(SR 1437 to Pinewood Dr.)	0.8	88	18	2	6		N	N	0	1	11,000	1,200	2,600	ADQ	ADQ
(Pinewood Dr. to US 74-76 Bus.)	0.6	58	18	2	6		N	N	0	1	11,000	900	1,900	ADQ	ADQ
SR 1552 [SMYRNA RD.]															
(US 701 Byp. to SR 1551)	1.8	88	18	2	7		N	N	0	1	13,000	2,300	3,400	ADQ	ADQ
(SR 1551 to SR 1585)	2.2	88	18	2	7		N	N	0	1	13,000	800	2,100	ADQ	ADQ
SR 1706 [SPIVEY RD.]/Warrior Trail															
(US 74-76 Bus. to US 701)	1.9	56	15	2	5		N	N	1	1	11,000	800	2,000	ADQ	ADQ

STREET INVENTORY

[METRIC UNITS]

FACILITY AND SECTION	EXISTING CONDITIONS: DIST. (km.)	SPEED (km/h)	ROW (m.)	# OF LANES	PVMT. (m.)	PVD. SHLD. (m.)	C&G	PARK.	# STOP LIGHTS	# STOP SIGNS	PRACTICAL CAPACITY LOS D	1994 ADT	2020* ADT	RECOMMENDED X-SECTION	RECOMMENDED ROW
SR 1916 [LEE ST.]															
(US 74-76 Bus. to Wyche St.)	0.3	56	17	2	6		N	N	1	0	9,900	4,600	8,300	ADQ	ADQ
(Wyche St. to Frazier St.)	1.8	56	17	2	12		L/R	N	0	0	9,900	4,600	8,300	ADQ	ADQ
(Frazier St. to US 701 Bus.)	0.3	56	18	2	8		N	N	1	0	9,900	4,600	8,300	ADQ	ADQ
SR 1920 [MILLPOND RD.]															
(NC 130 to SR 1951)	0.6	56	12	2	5		N	N	0	0	11,000	1,500	2,900	ADQ	ADQ
(SR 1951 to 0.2 mi east US 701 Bus.)	1.0	88	12	2	5		N	N	0	0	11,000	1,500	2,900	ADQ	ADQ
(0.2 mi east US 701 Bus. to US 701 Bus.)	0.3	56	12	2	5		N	N	0	0	11,000	1,500	2,900	ADQ	ADQ
SR 1953 [FRANKLIN ST.]															
(US 701 Bus. to Commerce St.)	0.5	56	18	2	6	0	N	N	1	0	9,900	5,300	9,300	ADQ	ADQ
(Commerce St. to E. Main St.)	0.3	56	14	2	6	0	N	N	0	0	9,900	5,300	9,300	ADQ	ADQ
(E. Main St. to Virgil St.)	0.2	32	18	2	14		L/R	N	0	0	9,900	5,300	9,300	ADQ	ADQ
(Virgil St. to Williamson St.)	1.0	56	18	2	14		L/R	N	0	0	9,900	5,300	9,300	ADQ	ADQ
(Williamson St. to Nance St.)	0.8	56	15	2	6		N	N	1	0	9,900	5,300	9,300	ADQ	ADQ
(Nance St. to Fuller St.)	0.3	56	18	2	14		L/R	N	0	1	9,900	5,300	9,300	ADQ	ADQ
BURKHEAD ST.															
(SR 1439 to Stanley St.)	1.0	56	18	2	13		L/R	N	0	1	9,900	2,000	4,100	ADQ	ADQ
(Stanley St. to US 701)	0.3	56	14	2	8		L/R	N	0	2	9,900	2,000	4,100	ADQ	ADQ
LEWIS ST./OLD TRAM RD.															
(US 701 to Maultsby St.)	1.1	56	14	2	6		N	N	0	5	9,900	1,500	3,100	ADQ	ADQ
(Maultsby St. to US 74-76 Bus.)	1.1	56	15	2	7		N	N	1	0	9,900	1,500	3,100	ADQ	ADQ

*NOTE: The 2020 ADT projection is without the Thoroughfare Plan system in place.

DEFINITION OF TERMS:

ADT	Average Daily Traffic	L	Left	PVMT	Pavement Width
ADQ	Adequate	k	kilometers	R	Right
C&G	Curb & Gutter	N	None	ROW	Right of Way
DIST	Distance	PARK	Parking	X-SECTION	Cross Section
m	meters	PVD.SHLD	Paved Shoulder Width		

See Definition of Terms & Note on last page

WHITEVILLE-BRUNSWICK THOROUGHFARE PLAN
STREET INVENTORY

[ENGLISH UNITS]

FACILITY AND SECTION	EXISTING CONDITIONS: DIST. (MI.)	SPEED LIMIT	ROW (FT.)	# OF LANES	PVMT. (FT.)	PVD. SHLD. (FT.)	C&G	PARK.	# STOP LIGHTS	# STOP SIGNS	PRACTICAL CAPACITY LOS D	1994 ADT	2020* ADT	RECOMMENDED X-SECTION	RECOMMENDED ROW
US 74-76 BYPASS															
(SR 1585 to SR 1552/Smyrna Rd.)	2.5	55	200	4	50	16	N	N	0	0	49,400	9,400	16,600	ADQ	ADQ
(SR 1552 to White Marsh Bridge)	2.5	55	200	4	50	16	N	N	0	0	49,400	7,300	13,900	ADQ	ADQ
US 74-76 BUSINESS															
(White Marsh Bridge to 0.2 mi east Columbus Apparel St.)	0.4	55	90	2	25		N	N	0	0	16,200	8,600	16,300	ADQ	ADQ
(0.2 mi east Columbus Apparel St. to Thompson St.)	1.1	45	65	4	52		L/R	N	2	0	30,800	8,600	16,300	ADQ	ADQ
(Thompson St. to SR 1953)	0.1	35	65	4	52		L/R	N	0	0	30,800	8,600	16,300	ADQ	ADQ
(SR 1953 to SR 1916)	0.3	20	60	2	43		L/R	L/R	1	0	14,300	10,500	18,000	G	ADQ
(SR 1916 to Grove St.)	0.4	35	60	2	43		L/R	N	1	0	14,300	9,000	15,500	G	ADQ
(Grove St. to SR 1554)	0.7	35	60	2	23		N	N	0	0	14,300	6,200	10,400	ADQ	ADQ
(SR 1554 to SR 1440)	0.8	45	60	2	23		N	N	0	0	13,000	6,200	10,400	ADQ	ADQ
(SR 1440 to SR 1585)	1.3	55	60	2	23		N	N	0	0	13,000	6,200	10,400	ADQ	ADQ
US 701															
(nbl to Jcn. US 701 Bus./Byp.)	1.2	55	200	2	34		N	N	0	0	14,100	9,900	21,350	C	ADQ
(Jcn. US 701 Bus./Byp. to US 74-76)	1.0	55	200	2	22	1	N	N	0	0	13,000	5,900	13,400	C	ADQ
(US 74-76 interchange)	0.2	55	100	4	48	6	N	N	0	0	28,000	14,200	27,700	ADQ	ADQ
(interchange to US 74-76 Bus.)	0.7	45	100	3	34	2	N	N	1	0	23,200	14,200	27,700	C	ADQ
(US 74-76 Bus. to W. Virgil St.)	1.0	45	100	5	43		L/R	N	1	0	28,000	14,200	27,700	ADQ	ADQ
(Virgil St. to Talbot St.)	0.6	55	200	2	23		N	N	0	0	13,000	13,400	25,500	C	ADQ
(Talbot St. to Hay St.)	0.8	55	200	3	34		N	N	0	0	23,200	13,400	25,500	C	ADQ
(Hay St. to Jcn. NC 130)	0.2	45	150	4	46		N	N	1	0	30,800	13,400	25,500	ADQ	ADQ
(Jcn. NC 130 to W'ville CL)	0.7	45	150	2	22		N	N	0	0	13,000	13,400	25,500	C	ADQ
(W'ville CL to SR 1170)	1.4	55	150	2	22		N	N	0	0	13,000	9,600	17,300	C	ADQ
US 701 BUSINESS															
(Jcn. NC 130 to SR 1953)	1.2	45	65	5	54		L/R	N	1	0	28,000	17,300	29,000	ADQ	ADQ
(SR 1953 to Pecan St.)	0.2	20	45	2	43		L/R	R	0	0	10,700	17,300	29,000	G	ADQ
(Pecan St. to Webster St.)	0.5	20	40	2	35		L/R	L/R	5	0	10,700	6,900	14,100	G	ADQ
(Webster St. to Jefferson St.)	0.6	35	40	2	35		L/R	L/R	0	0	10,700	6,900	14,100	G	ADQ
(Jefferson St. to Frink St.)	0.8	20	50	2	43		L/R	L/R	0	0	10,700	3,800	8,400	ADQ	ADQ
(Frink St. to Richardson St.)	0.6	35	60	2	36		L/R	N	0	0	14,100	3,800	8,400	ADQ	ADQ
(Richardson St. to SR 1705)	0.2	35	50	2	25		N	N	0	0	14,100	3,800	8,400	ADQ	ADQ

STREET INVENTORY

[ENGLISH UNITS]

FACILITY AND SECTION	EXISTING CONDITIONS: DIST. (MI.)	SPEED LIMIT	ROW (FT.)	# OF LANES	PVMT. (FT.)	PVD. SHLD. (FT.)	C&G	PARK.	# STOP LIGHTS	# STOP SIGNS	PRACTICAL CAPACITY LOS D	1994 ADT	2020* ADT	RECOMMENDED X-SECTION	RECOMMENDED ROW
US 701 BUSINESS															
(SR 1705 to Jcn. US 701)	0.4	55	60	2	23		N	N	0	0	13,000	3,800	8,400	ADQ	ADQ
NC 130															
(SR 1966 to SR 1171)	0.7	55	60	2	22		N	N	0	0	13,000	7,500	12,600	C	90
(SR 1171 to SR 1950)	0.4	35	60	2	44		L/R	N	0	0	14,100	7,500	12,600	C	90
(SR 1950 to Jcn. US 701 Byp.)	1.3	45	100	2	25	6	N	N	2	0	14,100	8,100	15,000	C	ADQ
SR 1166 (PLEASANT PLAINS RD.)															
(US 701 to SR 1170)	1.2	45	60	2	21		N	N	0	1	12,000	2,800	4,000	ADQ	ADQ
SR 1429 (SLIPPERY LOG RD.)															
(US 701 to SR 1434)	1.1	55	60	2	20		N	N	0	1	12,000	2,600	4,400	ADQ	ADQ
(SR 1434 to SR 1437)	1.6	55	60	2	20		N	N	0	1	12,000	2,700	6,000	ADQ	ADQ
SR 1437 (PINE LOG RD.)															
(West Planning Boundary to Baldwin Cr.)	2.9	55	60	2	20		N	N	0	1	12,000	600	1,500	ADQ	ADQ
(Baldwin Cr. to US 701)	0.6	35	50	2	18		L/R	N	1	0	12,000	4,300	10,500	ADQ	ADQ
SR 1439 (HEALTH CENTER RD.)															
(SR 1437 to Pinewood Dr.)	0.5	55	60	2	19		N	N	0	1	11,000	1,200	2,600	ADQ	ADQ
(Pinewood Dr. to US 74-76 Bus.)	0.4	35	60	2	19		N	N	0	1	11,000	900	1,900	ADQ	ADQ
SR 1552 (SMYRNA RD.)															
(US 701 Byp. to SR 1551)	1.1	55	60	2	23		N	N	0	1	13,000	2,300	3,400	ADQ	ADQ
(SR 1551 to SR 1585)	1.4	55	60	2	23		N	N	0	1	13,000	800	2,100	ADQ	ADQ
SR 1706 (SPIVEY RD.)/Warrior Trail															
(US 74-76 Bus. to US 701)	1.2	35	50	2	18		N	N	1	1	11,000	800	2,000	ADQ	ADQ

See Definition of Terms & Note on lost poge

WHITEVILLE-BRUNSWICK THOROUGHFARE PLAN
STREET INVENTORY

[ENGLISH UNITS]

FACILITY AND SECTION	EXISTING CONDITIONS: DIST. (MI.)	SPEED LIMIT	ROW (FT.)	# OF LANES	PVMT. (FT.)	PVD. SHLD. (FT.)	C&G	PARK.	# STOP LIGHTS	# STOP SIGNS	PRACTICAL CAPACITY LOS D	1994 ADT	2020* ADT	RECOMMENDED X-SECTION	RECOMMENDED ROW
SR 1916 [LEE ST.]															
(US 74-76 Bus. to Wyche St.)	0.2	35	55	2	20		N	N	1	0	9,900	4,600	8,300	ADQ	ADQ
(Wyche St. to Frazier St.)	1.1	35	55	2	40		L/R	N	0	0	9,900	4,600	8,300	ADQ	ADQ
(Frazier St. to US 701 Bus.)	0.2	35	60	2	26		N	N	1	0	9,900	4,600	8,300	ADQ	ADQ
SR 1920 [MILLPOND RD.]															
(NC 130 to SR 1951)	0.4	35	40	2	18		N	N	0	0	11,000	1,500	2,900	ADQ	ADQ
(SR 1951 to 0.2 mi east US 701 Bus.)	0.6	55	40	2	18		N	N	0	0	11,000	1,500	2,900	ADQ	ADQ
(0.2 mi east US 701 Bus. to US 701 Bus.)	0.2	35	40	2	18		N	N	0	0	11,000	1,500	2,900	ADQ	ADQ
SR 1953 [FRANKLIN ST.]															
(US 701 Bus. to Commerce St.)	0.3	35	60	2	20	1	N	N	1	0	9,900	5,300	9,300	ADQ	ADQ
(Commerce St. to E. Main St.)	0.2	35	45	2	20	1	N	N	0	0	9,900	5,300	9,300	ADQ	ADQ
(E. Main St. to Virgil St.)	0.1	20	60	2	45		L/R	N	0	0	9,900	5,300	9,300	ADQ	ADQ
(Virgil St. to Williamson St.)	0.6	35	60	2	45		L/R	N	0	0	9,900	5,300	9,300	ADQ	ADQ
(Williamson St. to Nance St.)	0.5	35	50	2	21		N	N	1	0	9,900	5,300	9,300	ADQ	ADQ
(Nance St. to Fuller St.)	0.2	35	60	2	48		L/R	N	0	1	9,900	5,300	9,300	ADQ	ADQ
BURKHEAD ST.															
(SR 1439 to Stanley St.)	0.6	35	60	2	44		L/R	N	0	1	9,900	2,000	4,100	ADQ	ADQ
(Stanley St. to US 701)	0.2	35	45	2	25		L/R	N	0	2	9,900	2,000	4,100	ADQ	ADQ
LEWIS ST./OLD TRAM RD.															
(US 701 to Maultsby St.)	0.7	35	45	2	19		N	N	0	5	9,900	1,500	3,100	ADQ	ADQ
(Maultsby St. to US 74-76 Bus.)	0.7	35	50	2	24		N	N	1	0	9,900	1,500	3,100	ADQ	ADQ

*NOTE: The 2020 ADT projection is without the Thoroughfare Plan system in place.

DEFINITION OF TERMS:

ADT	Average Daily Traffic	L	Left	PVMT	Pavement Width
ADQ	Adequate	MI	Miles	R	Right
C&G	Curb & Gutter	N	None	ROW	Right of Way
DIST	Distance	PARK	Parking	X-SECTION	Cross Section
FT	Feet	PVD.SHLD.	Paved Shoulder Width		

APPENDIX B

B. TRAFFIC MODEL DEVELOPMENT

A traffic model for the Whiteville/Brunswick Urban Area was developed to produce an efficient thoroughfare plan of the study area. The sketch plan method is used to analyze the traffic. Development of a traffic model consists of: defining the study area, collecting traffic counts and socioeconomic data, using the trip generation characteristics, and calibrating the traffic model so that it duplicates traffic patterns of the study area. Details of this process are discussed later in this chapter. Once the base year model is calibrated, traffic counts and socioeconomic data are projected to the design year, 2020. The model may then be used to evaluate various street system problems.

The Planning Area

The planning area for Whiteville/Brunswick consists of the city limits, extra-territorial jurisdiction, and some additional outlaying area (See Figure A1). The planning area was divided into 10 zones for data collection and aggregation. These zones reflect similar land use throughout the planning area. The data for the rural dwelling units (those houses outside the city limits but inside the planning area) were taken from the 1987 USGS quad maps. The data for the urban dwelling units (inside the city limits) was based on the number of persons per dwelling unit and the urban population. The census data was used to determine county employment for 1994 while other employment figures were estimated based on past trends. The projections of socioeconomic data to the future year was done based on past trends from previous census data and projections by the Office Budget and State Planning and the local staff.

Data Requirements

Two additional types of data are required to adequately analyze the planning area. First, traffic counts on major and minor thoroughfares are collected. These traffic counts show a snapshot of traffic conditions as they are today in the planning area. (See Figure A2.) Second, socioeconomic data (population, housing counts from quad maps and employment estimates) are necessary in order to generate traffic for future projections. (See Trip Generation Worksheet.)

Traffic Counts - The street system must be compared against existing conditions in the planning area. For this comparison, traffic counts must be taken at various locations around the planning area. The counts for the Whiteville/Brunswick urban area were collected during 1993 & 1994. (See Figure A1.)

Also, traffic volumes on all routes crossing the planning area boundary were determined using the nearest ADT count. These external traffic counts show how much traffic is entering and exiting the planning area.

Socioeconomic Data - The required data consists of population figures, house counts from quad maps and employment estimates. The population and housing counts are used

in the study as the generator of trips. Employment is used as the attractor of trips. A trip generation rate of 7.0 was assigned to the planning area based on the average number of trips made from a household in a single day. See Trip Generation worksheets.

Commercial Vehicles

Commercial vehicles have somewhat different trip generation characteristics than do privately owned vehicles. For the purposes of this systems analysis, a Commercial Trip Generation Factor of 0.14 (percent of DU trips) was chosen based on an origin and destination survey of a similar size town (Ahoskie, NC) taken from Technical Report #11 (Allocation Type Approach To Estimatation of Travel For Small Urban Areas by Marion R. Poole, Ph.D., P.E.).

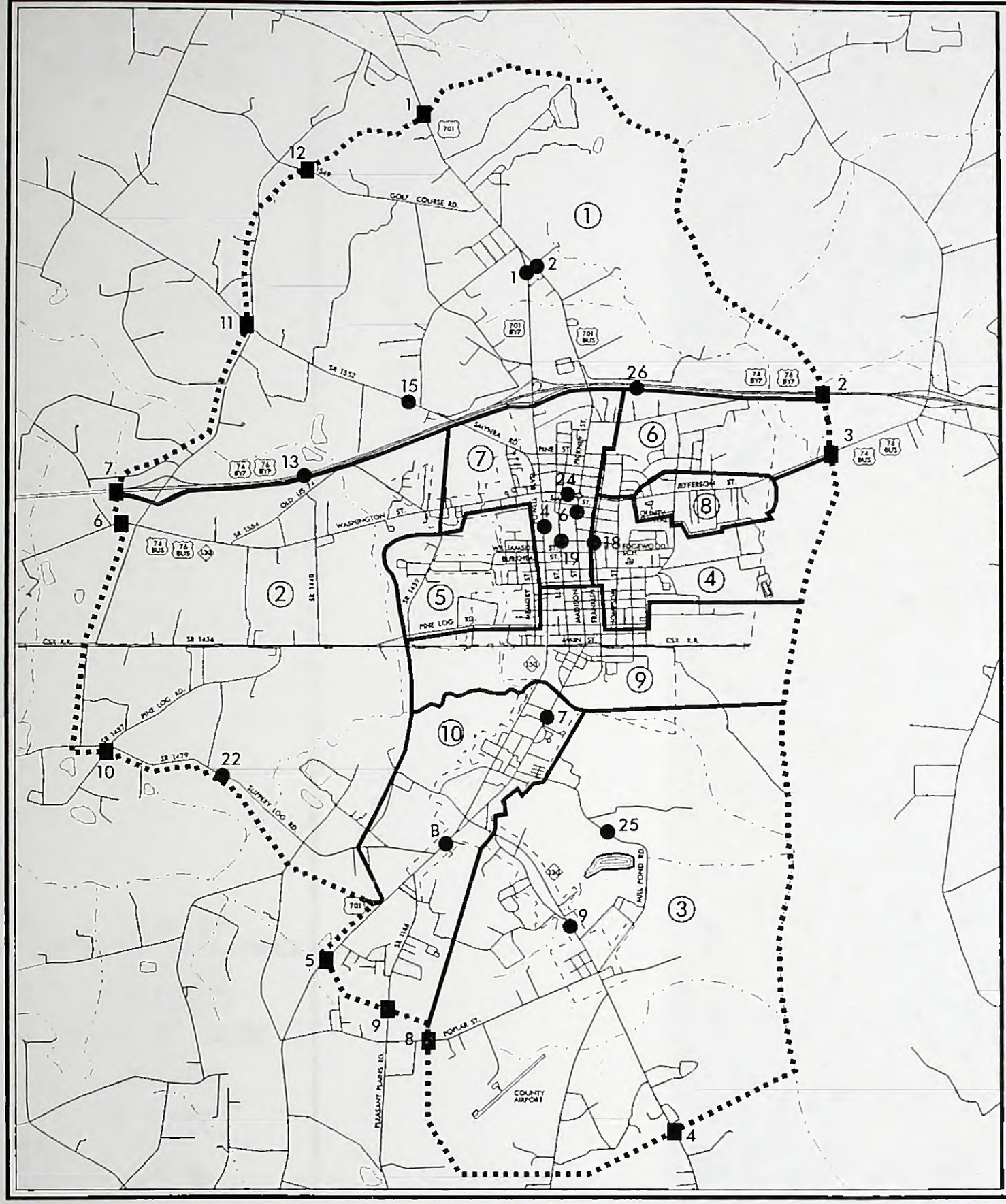
Trip Generation

The trip generation process is the process by which population and housing data and employment data are used to generate traffic volumes that duplicate the traffic volumes on the street network. The technical definition of a trip is slightly different than the definition of a trip used by the general public. Technically a trip only has one origin and one destination while the layman will often group, or chain, several short trips together as one longer trip. Traffic inside the planning area has three major components: through trips, internal-external trips, and internal trips.

Through trips are produced outside the planning area and pass through en route to a destination outside the planning area. For example, vacationers from northern North Carolina headed to the beaches. **Internal-external trips** have one end of the trip outside of the planning area. For example, a person lives in Tabor City but travels to Whiteville to work. **Internal trips** have both their origin and destination inside the planning area.

Through Trips - The Through Trip Table for this study was developed using Technical Report Number 3 (Synthesized Through Trip Table for Small Urban Areas by Dr. David G. Modlin, Jr.) and the Computer Supplement (Synthesized Through Trip Table for Small Urban Areas by James Tyler McDonnell) as a guide.

In developing the through trip table, the through trip percentages were entered into the computer synthesis program along with the ADT counts, functional class of the road, the percent of trucks and the route continuity. The program generated through trip percentages for each station. These percentages were modified to more accurately represent the actual traffic patterns of the area. The program then created an unbalanced matrix of all through trip possibilities and then balanced the trips so that the total number of through trips at each external station is consistent with the total number of through trips at every other station. Eight iterations were sufficient to balance the error between external zones.



ZONE MAP

LEGEND

- PLANNING AREA BOUNDARY
- ZONE LINE
- (0) ZONE NUMBER
- ■ CORDON STATION
- ● ASSIGNMENT STATION

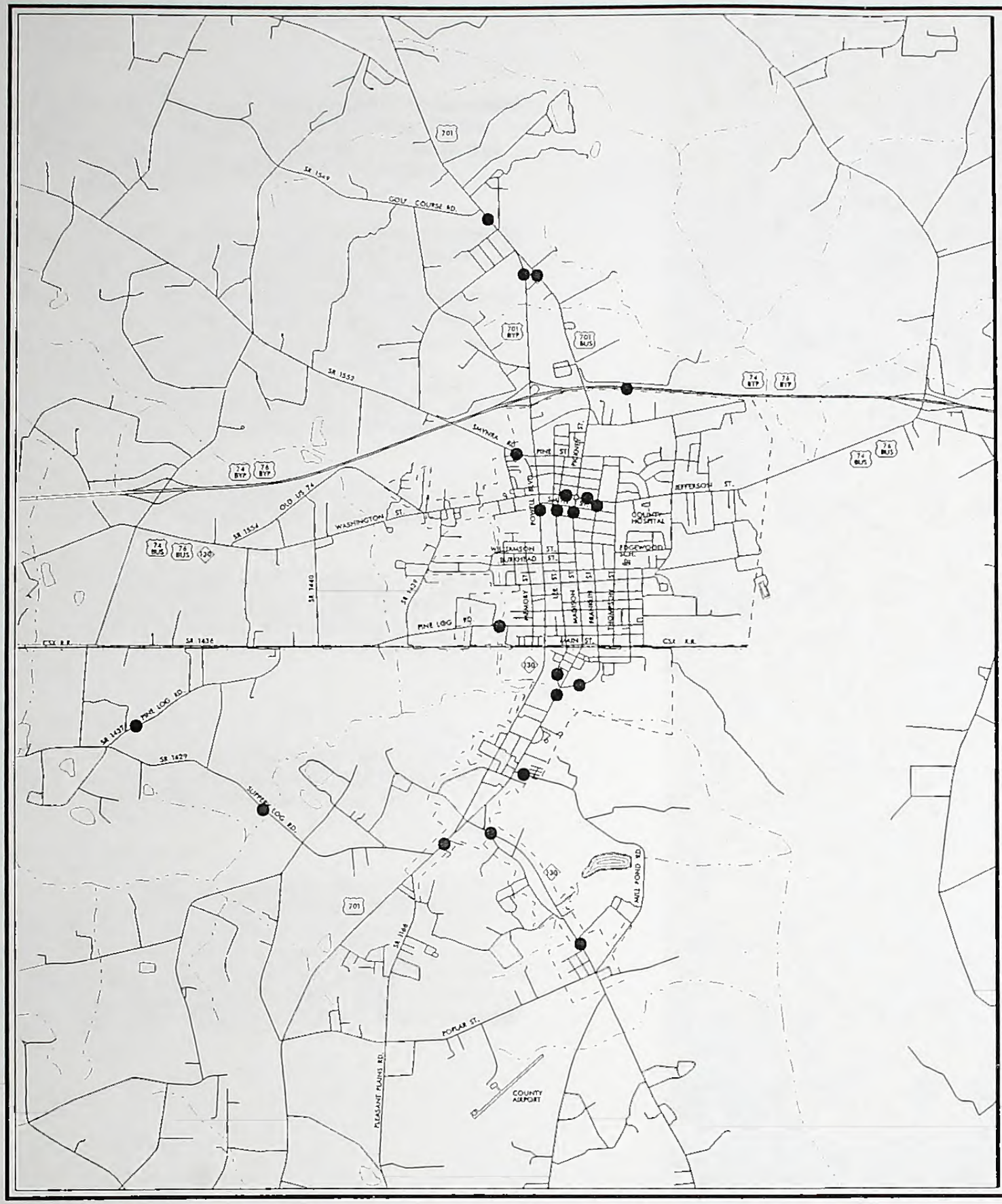
N

FIGURE B1
WHITEVILLE /BRUNSWICK
URBAN AREA
COLUMBUS COUNTY
NORTH CAROLINA

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS-STATEWIDE PLANNING BRANCH

U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION

Base map date
DECEMBER 1994



ADT STATION LOCATIONS

● ADT STATION

N

FIGURE B2
WHITEVILLE /BRUNSWICK
URBAN AREA
COLUMBUS COUNTY
NORTH CAROLINA

PREPARED BY
NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS-STATEWIDE PLANNING BRANCH
IN COOPERATION WITH THE
U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION

SCALE
0 1 MILE
0 5000 10000 FEET

Base map date
DECEMBER 1994

The output from the program was put into the model. It was determined that incremental changes needed to be made in order to further refine the traffic movements. Initially, some trips were re-assigned to other destinations. Finally, the number of through trips were reduced at certain locations until the model was balanced and no further modifications would aid in the calibration.

Internal-External Trips - Internal -External trips consist of internal-external trips plus external-internal trips. External-Internal trips are equal to the external production ($\sum$ADT) at the cordon - thru trip ends - internal-external trips. This volume was determined by first multiplying the total number of internal trips generated by population and development by the employment to population reduction factor to get the total number of internal- internal trips. The total number of internal- internal trips is then subtracted from the total number of internal trips generated by population and development to get the total internal-external trips. The employment to population reduction factor increases as the ratio of employment to population decreases. Thus, as the factor increases the number of internal-external trips decreases. (See page 2 of Trip Generation Worksheet.)

Internal Trips - The number of internal trips is the difference between the total number of trips generated by population and development and the total number of internal-external trips.

NonHome Based Secondary Trips - Non Home based secondary trips are calculated from the external-internal trips. These secondary trips are trips that are housed outside the planning area, but come inside to work or shop. While these trips are visiting the planning area, they make additional trips like to a restaurant for lunch if they come inside the planning area to work.

Internal Trip Distribution

Once the number of internal trips per traffic zone were determined, the trips were distributed to other traffic zones. This was achieved using engineering judgement based on knowledge of the area, urban area land use and general attractiveness of each zone.

Model Calibration

A traffic model is used to predict the traffic on a street system at some future point in time. Therefore, the model must duplicate the existing traffic pattern. The actual calibration of the model is an interactive process in which incremental changes are made either in the trip generation, trip distribution, or the through trips. The purpose of each change is to allow the model to more accurately reflect the real world conditions upon which it is based. Only when the model can adequately reflect the existing traffic pattern should it be used to predict traffic in the future. The model was calibrated using 1993-94 Average Daily Traffic Counts on all routes that

were available. The one year difference on some of the data collected was not a significant increase.

Accuracy Checks

There are two checks made on the model. The first is to follow trips through all the steps involved in the model. The purpose of this check is to insure that no trips have been accidentally added to or subtracted from the model, and that no trips have been counted twice.

The final check for the model is to match the traffic volumes at the internal count stations in the model with the known ADT at the same location. The internal counts can be used to find particular places in the network where there are problems. Again, these problems must be corrected by incremental adjustments of either the trip generation, trip distribution, or the through trips.

Data Projections to the Design Year

In order to make use of the model the base year data must be modified to reflect assumed conditions in the design year. These projections and the previously developed regression equations were used to produce trip productions and attractions in the same manner as the base year.

1994 TRIP GENERATION WORKSHEET - Page 1 of 3

The Trip Generation Worksheet calculates the trips generated within the planning area. It also allocates trips to the proper traffic flow totals (ie. Internal>External trips,.Internal<>Internal trips) in order to develop trip tables and make assignments to the existing street system. *The highlighted areas require an input.

Step 1: Estimate the trips generated by the population and development within the planning area. Population is converted into dwelling units and then multiplied by the trip generation rate. Commercial automobile and truck trips are then estimated and added to this total.

Population	
1993 Population of Whiteville:	5,513
1993 Population of Brunswick:	299
Total:	5,812
1994 Est. Whiteville Population:	5,690
1994 Est. Brunswick Population:	310
Total:	6,000

DWELLING UNIT TRIPS

1994 Brunswick & W'ville Population (POP):	6,000
1970-1994 Growth Factor (GR):	1.19
1994 Trip Generation Factor/DU (DUTG):	7.00
1994 Whiteville City Person/DU (PDU):	2.40
1994 Planning Area Population:	9,978
1994 # DU's in Planning Area:	4,158

The 1994 Trip Gen. Factor/DU was chosen by KDH based on Technical Report #11. The values for persons/DU were based on the 1990 Whiteville Township value and adjusted for the year 1994 and the planning area. The 1994 planning area population was obtained by multiplying the total # of houses outside of the city limits, but within the planning area, by the # of persons/DU and adding the product to the Whiteville/Brunswick population. The total # DU's in the planning area was obtained by dividing the total city population by the # of persons/DU and adding this # to the total # of rural DU's.

TABLE 1 gives a breakdown of the number of Dwelling Units by zone (outside the city limits of Whiteville/Brunswick but inside the planning area) and calculates the trips generated. The number of houses outside the city limits was taken from the 1987 USGS quad maps, and are considered rural. The growth factor (GR) is used to bring the 1987 DU's up to date with the 1994 base year.

TABLE 2 calculates trips generated within the city limits from the population and person/DU factor. The population is placed into traffic zones by percentages through estimation.

1994 TRIP GENERATION WORKSHEET - Page 2 of 3

TABLE 1- Rural Trip Generation				TABLE 2 - City Trip Generation				TOTAL
	# Houses outside City Limits		# Trips Gen.		Whiteville/Brunswick 1994 Population		# Trips Gen.	# DU Trips
Traffic Zone	1987 (Hc)	1994 (He)	1994 (TPrur)	Traffic Zone	% (ZPOP%)	# (ZPOP#)	1994 (TPcty)	(TPdu)
I	331	394	2,757	I	0.0	0	0	2,757
II	306	364	2,549	II	1.5	90	263	2,811
III	480	571	3,998	III	3.5	210	613	4,611
IV	0	0	0	IV	19.0	1,140	3,325	3,325
V	44	52	367	V	12.0	720	2,100	2,467
VI	0	0	0	VI	17.0	1,020	2,975	2,975
VII	4	5	33	VII	24.0	1,440	4,200	4,233
VIII	0	0	0	VIII	5.0	300	875	875
IX	11	13	92	IX	11.0	660	1,925	2,017
X	217	258	1,808	X	7.0	420	1,225	3,033
Totals:	1,393	1,658	11,604	Totals:	100.0	6,000	17,500	29,104

Hc = 1987 Houses counted on quad map (inside planning area, but outside city limits).
He = 1994 Houses estimated = (Hc * GR)
ZPOP% = estimated % of city population within each zone.
ZPOP# = amount of city population within each zone = ([ZPOP%/100] * POP)
TPcty = City generated trips = ([ZPOP#/PDU] * DUTG).
TPdu= (TPrur + TPcty)

Total # DU Trips (TPdu): 29,104

COMMERCIAL TRIPS

1994 Commercial Trips (TPcom)	
4,075	Commercial Trip Generation Factor (CG): 0.14
	(TPcom) = # of commercial trips gen. = (TPdu * CG).
	The 1994 Comm. Trip Gen. Factor was taken from Tech. Report 11, Table 1, using Ahoskie as the closest match to Whiteville, then adjusted per KDH.

Total # of Internal Trips by Pop. & Development (TPin): 33,178
TPin = (TPdu + TPcom).

Step 2: Internal trips are calculated. We can now calculate the number of internal trips with external destinations. The number of trips that stay in the planning area is in direct proportion to the number of employers inside the planning area compared with population. The Employment/Population Reduction Factor (EPR) is estimated using employment/population ratio and borrowed data from older studies. The EPR is multiplied by the total number of internal trips generated by Population & Development. The result is the number of internal trips which stay inside the planning area (II). The remainder trips have external destinations (IE).

1994 TRIP GENERATION WORKSHEET - Page 3 of 3

INTERNAL-EXTERNAL TRIPS

Employment/Population Ratio(s)

	Employ.	Pop.	Employ/Pop
County	24,247	50,249	0.48
Twnshp.	5,331	10,369	0.51
City	2,594	6,000	0.43
Average Employ/Pop Ratio:			0.48
Plan Area	4,490	9,978	0.45

Employ/Pop Reduction Factor (EPR): 0.75

INTERNAL TRIP DISTRIBUTION

# with Ext. dest. (TPi-e)	# with Int. dest. (TPi-I
8,295	24,884

TPi-e = # of internally generated trips with external destinations = (TPin-(TPin * EPR)).
TPi-I = # of internally generated trips with internal destinations = (TPin -TPi-e).
The values for population are the 1994 projected population values. The value for county employment is the 1994 actual value for the Labor Force. All other employment values are estimated.

Step 3: NonHome Based Secondary trips are added to internal trips with internal destinations (II). NonHome Based Secondary trips are made by external trips (E-I which enter the planning area. The Secondary Trip Generation Factor was taken from Technical Report #11, Table 2, using Ahoski as the closest match toWhiteville (per KDH). External trips with internal destinations (E-I are computed by subtracting thru trip ends (E-E) and internally generated trips with external destinations (IE) from the external production (CADT). See the Cordon Worksheet.

SECONDARY TRIPS

Secondary Trip Generation Factor (NHB):	0.324
E-I Trips (TPe-I:	22,473
NHB Secondary Trips (TPnhb):	7,281

GRAND TOTAL 1994 INTERNAL TRIPS (TPintot): 32,165

Cordon ADT (CADT):	67,780	(from CORDON)
Thru Trips (TPe-e):	18,506	(from CORDON)
External Trips:	30,768	(CADT - [TPe-e * 2])
I-E Trips (TPi-e):	8,295	(from above)
E-I Trips (TPe-i):	22,473	(CADT - [TPe-e * 2] - TPi-e)
I-I Trips (TPi-i):	24,884	(from above)
NHB Trips (TPnhb):	7,281	(E-I Trips * NHB %age)

TPe-e = # of externally gen. trips with external destinations (thru trips).
TPe-i = # of externally gen. trips with internal destinations.
TPnhb = # of secondary non-home-based trips.
TPintot = total # of internal trips with internal destinations = (TPi-I + TPnhb).

AVERAGE DAILY TRAFFIC AT TRAFFIC STATIONS

Enter the Average Daily Traffic at all of the cordon stations and internal count stations here. This is a input worksheet for the Thru Trip calculation and distribution, and the External Trips distribution. (See the Summary of Trips, Cordon, and Trip Distribution worksheets.) *The highlighted areas require an input.

AVERAGE DAILY TRAFFIC AT CORDON STATIONS

STA.	ROUTE	Base Yr 1994
1.	US 701 North	9900
2.	US 74/76 BYP E.	7300
3.	US 74/76 BUS E.	8600
4.	NC 130 SE	8500
5.	US 701 South	9600
6.	US 74/76 BUS W.	6200
7.	US 74/76 BYP W.	9000
8.	SR 1170	2000
9.	SR 1166	2800
10.	SR 1429	2700
11.	SR 1552	800
12.	SR 1549	380

AVERAGE DAILY AT INTERNAL COUNT STATIONS

STA.	ROUTE	Base Yr 1994
1.	US 701 BYP. S. of US 701N	5900
2.	US 701 BUS. S. of US 701N	3800
4.	US 701 BYP. S. of US 74/76 BU	14200
6.	US 701 BUS. S. of US 74/76 BU	6900
7.	US 701 BUS. S. of SR 1916/195	17300
8.	US 701 S. of SR 1429	13400
9.	NC 130 S., N of Brunswick	8100
13.	US 74/76 BYP. E. of SR 1585	9400
15.	SR 1552 W. of SR 1551	2300
18.	SR 1953 N. of Lewis St.	5300
19.	SR 1916 N. of Burkhead St.	4600
22.	SR 1429 E. of SR 1434	2600
24.	US 74/76 BUS. E. of SR 1916	10500
25.	SR 1920	1500
26.	US 74/76 BYP. ATR Station	7300

1994 TRIP DISTRIBUTION WORKSHEET - Page 1 of 4

Step 4: This worksheet allocates the traffic flow grand totals to zones using trip tables. (Traffic flow grand totals were calculated in the Trip Generation worksheet.) The grand total is divided between the zones. The total trips in each zone are calculated below. The engineer must first determine the percentages, instead of numbers, from station/zone to zone/station (depending on which traffic flow total you are working on). Using percentages will help keep the traffic flow ie, station to zone on the right course. *The highlighted areas require an input.

Zone No.	Trips Generated by Pop. & Development DU Trips (TPdu)	Comm. Trips (TPcomm)	Total (TPin)	# Trips w/ ext. dest. (TPi-e)	int. dest. (TPi-I	(SEC) NHB Trips (TPnhb)
I	2,757	386	3,143	786	2,357	182
II	2,811	394	3,205	801	2,404	146
III	4,611	646	5,256	1,314	3,942	437
IV	3,325	466	3,791	948	2,843	364
V	2,467	345	2,812	703	2,109	801
VI	2,975	417	3,392	848	2,544	109
VII	4,233	593	4,826	1,206	3,619	1,675
VIII	875	123	998	249	748	1,019
IX	2,017	282	2,299	575	1,724	1,092
X	3,033	425	3,457	864	2,593	1,456
Total:	29,104	4,075	33,178	8,295	24,884	7,281

TPdu = TPrur + TPcty
TPcom = TPdu * C (CG = 0.14 Commercial Gen Factor)
TPin = TPdu + TPcom
TPi-e = TPin * EPR (EPR = 0.75, Employ/Pop Reduction Factor)
TPi-I = TPin - TPi-e

INTERNAL-EXTERNAL

The Internal-External (IE) trip table allocates percentages from zones to stations, for means of obtaining traffic coming into that zone from an external destination. Next these trips will placed on internal stations which they would likely encounter while traveling from a certain zone to station.

IE TRIPS (%)	From Zone	Trips	% IE Trips (from zone to station) to cordon sta. 1	2	3	4	5	6	7	8	9	10	11	12	Total
	I	786	16.0	16.0	0.0	12.0	19.0	14.0	12.0	1.0	3.0	1.0	3.0	3.0	100.0
	II	801	16.0	20.0	8.0	9.0	10.0	14.0	8.0	0.0	3.0	11.0	1.0	0.0	100.0
	III	1,314	10.0	9.0	10.0	18.0	10.0	10.0	12.0	10.0	3.0	5.0	1.0	2.0	100.0
	IV	948	18.0	1.0	18.0	10.0	18.0	15.0	13.0	1.0	1.0	2.0	3.0	0.0	100.0
	V	703	10.0	10.0	17.5	10.0	15.0	14.5	15.0	0.0	2.0	3.0	3.0	0.0	100.0
	VI	848	10.0	10.0	28.0	12.5	15.0	10.0	12.0	0.0	0.0	0.0	2.5	0.0	100.0
	VII	1,206	10.0	9.0	14.0	12.0	20.0	15.0	10.0	0.0	2.0	5.0	2.0	1.0	100.0
	VIII	249	12.0	0.0	20.0	12.0	16.0	11.0	12.0	3.0	2.0	2.0	5.0	5.0	100.0
	IX	575	12.0	10.0	12.0	10.0	10.0	10.0	12.0	2.0	2.0	12.0	4.0	4.0	100.0
	X	864	12.0	8.0	15.0	8.0	11.0	12.0	9.0	3.0	6.0	11.0	3.0	2.0	100.0
	Total:	8,295													

1994 TRIP DISTRIBUTION WORKSHEET - Page 2 of 4

IE TRIPS (#)	From Zone	Trips	# IE Trips (from zone to station) to cordon sta. 1	2	3	4	5	6	7	8	9	10	11	12	Total
	I	786	126	126	0	94	149	110	94	8	24	8	24	24	785.8
	II	801	128	160	64	72	80	112	64	0	24	88	8	0	801.3
	III	1,314	131	118	131	237	131	131	158	131	39	66	13	26	1314.1
	IV	948	171	9	171	95	171	142	123	9	9	19	28	0	947.6
	V	703	70	70	123	70	105	102	105	0	14	21	21	0	703.0
	VI	848	85	85	237	106	127	85	102	0	0	0	21	0	847.9
	VII	1,206	121	109	169	145	241	181	121	0	24	60	24	12	1206.5
	VIII	249	30	0	50	30	40	27	30	7	5	5	12	12	249.4
	IX	575	69	57	69	57	57	57	69	11	11	69	23	23	574.7
	X	864	104	69	130	69	95	104	78	26	52	95	26	17	864.3
	Total:	8,295	1034	804	1144	975	1198	1052	944	194	203	431	201	115	8,295

INTERNAL-INTERNAL

The Internal-Internal (II) trip table allocates percentages from zones to zones, for means of obtaining traffic traveling internally from one zone to another zone. Next these trips will placed on internal stations which they would likely encounter while traveling from zone to zone.

II TRIPS (%)	From Zone	Trips	The number of II trips includes secondary trips. % II Trips (from zone to zone) to zone no. I	II	III	IV	V	VI	VII	VIII	IX	X	Total
	I	2,539	4.0	2.0	5.0	9.0	7.0	2.0	24.0	10.0	18.0	19.0	100.0
	II	2,549	2.0	4.0	15.0	7.0	8.0	3.0	20.0	10.0	15.0	16.0	100.0
	III	4,379	1.0	2.0	5.0	6.0	7.0	2.0	25.0	15.0	15.0	22.0	100.0
	IV	3,207	1.0	1.0	10.0	4.0	8.0	2.0	18.0	18.0	18.0	20.0	100.0
	V	2,910	2.0	1.0	20.0	10.0	4.0	1.0	21.0	12.0	10.0	19.0	100.0
	VI	2,653	2.0	1.0	5.0	8.0	7.0	4.0	17.0	20.0	18.0	18.0	100.0
	VII	5,294	1.5	1.0	6.0	6.0	9.0	2.5	23.0	14.0	18.0	19.0	100.0
	VIII	1,768	1.0	1.0	5.0	10.0	9.0	2.0	20.0	10.0	22.0	20.0	100.0
	IX	2,816	1.0	1.0	9.5	10.0	9.0	1.0	20.0	10.0	10.0	28.5	100.0
	X	4,049	0.5	2.0	12.5	6.0	6.0	1.0	22.0	15.0	20.0	15.0	100.0
	Total:	32,165											

II TRIPS (#)

The number of II trips includes secondary trips.

From Zone	Trips	# II Trips (from zone to zone) to zone no. I	II	III	IV	V	VI	VII	VIII	IX	X	Total
I	2,539	102	51	127	229	178	51	609	254	457	482	2539
II	2,549	51	102	382	178	204	76	510	255	382	408	2549
III	4,379	44	88	219	263	307	88	1095	657	657	963	4379
IV	3,207	32	32	321	128	257	64	577	577	577	641	3207
V	2,910	58	29	582	291	116	29	611	349	291	553	2910
VI	2,653	53	27	133	212	186	106	451	531	478	478	2653
VII	5,294	79	53	318	318	476	132	1218	741	953	1006	5294
VIII	1,768	18	18	88	177	159	35	354	177	389	354	1768
IX	2,816	28	28	268	282	253	28	563	282	282	803	2816
X	4,049	20	81	506	243	243	40	891	607	810	607	4049
Total:	32,165	485	508	2943	2320	2379	651	6879	4430	5275	6295	32165

EXTERNAL-INTERNAL

The External-Internal (E-I trip table allocates percentages from stations to zones, for means of obtaining traffic coming from an external destination outside the planning area to a zone. Next these trips will be placed on internal stations which they would likely encounter while traveling from a certain station to a zone.

E-I TRIPS

Cordon Sta.	ADT	Thru Trip	External Trips	IE Trips	E-I Trips
1	9900	7922	1978	1,034	944
2	7300	5842	1458	804	654
3	8600	3092	5508	1,144	4,364
4	8500	3036	5464	975	4,489
5	9600	7684	1916	1,198	718
6	6200	1848	4352	1,052	3,300
7	9000	7198	1802	944	858
8	2000	100	1900	194	1,706
9	2800	138	2662	203	2,459
10	2700	136	2564	431	2,133
11	800	12	788	201	587
12	380	4	376	115	261
Totals:	67780	37012	30768	8,295	22,473

1994 TRIP DISTRIBUTION WORKSHEET - Page 4 of 4

E-I TRIPS (%)

From Station	Trips	% E-I Trips (from station to zone) to zone no. I	II	III	IV	V	VI	VII	VIII	IX	X	Total
1	944	3.0	1.0	13.0	3.0	6.0	2.0	22.0	16.0	16.0	18.0	100.0
2	654	2.5	1.5	4.0	3.0	12.0	2.0	24.0	5.0	24.0	22.0	100.0
3	4,364	0.0	1.5	2.0	3.0	6.0	3.0	18.0	25.0	21.5	20.0	100.0
4	4,489	0.5	1.0	25.0	3.0	2.0	0.0	12.0	13.0	17.0	26.5	100.0
5	718	1.0	2.0	4.0	4.0	9.0	1.0	20.0	10.0	22.0	27.0	100.0
6	3,300	2.0	3.0	3.0	3.0	12.0	4.0	24.0	15.0	18.0	16.0	100.0
7	858	2.0	2.0	3.0	3.0	10.0	2.0	27.0	14.0	19.0	18.0	100.0
8	1,706	0.0	0.0	98.0	0.0	0.0	0.0	0.0	0.0	1.0	1.0	100.0
9	2,459	1.0	2.0	4.0	4.0	10.0	1.0	22.0	7.0	22.0	27.0	100.0
10	2,133	0.0	3.0	15.0	1.0	2.0	0.5	5.0	5.0	30.0	38.5	100.0
11	587	2	0	5	4	10	3	25	12	21	18	100.0
12	261	3	0.5	7	4	8	2	25.5	10	23	17	100.0
Total:	22,473											

E-I TRIPS (#)

From Station	Trips	# E-I Trips (from station to zone) to zone no. I	II	III	IV	V	VI	VII	VIII	IX	X	Total
1	944	28	9	123	28	57	19	208	151	151	170	944
2	654	16	10	26	20	78	13	157	33	157	144	654
3	4,364	0	65	87	131	262	131	786	1091	938	873	4364
4	4,489	22	45	1122	135	90	0	539	584	763	1190	4489
5	718	7	14	29	29	65	7	144	72	158	194	718
6	3,300	66	99	99	99	396	132	792	495	594	528	3300
7	858	17	17	26	26	86	17	232	120	163	154	858
8	1,706	0	0	1672	0	0	0	0	0	17	17	1706
9	2,459	25	49	98	98	246	25	541	172	541	664	2459
10	2,133	0	64	320	21	43	11	107	107	640	821	2133
11	587	12	0	29	23	59	18	147	70	123	106	587
12	261	8	1	18	10	21	5	67	26	60	44	261
Total:	22,473	202	375	3,650	621	1,401	377	3,717	2,921	4,306	4,905	22,473

1994 THRU TRIP DISTRIBUTION WORKSHEET - Page 1 of 2

This worksheet double checks the distribution of the Synthesis Thru Trip calculations and converts the number of vehicles into percentage of vehicles. The percentage of vehicles gives you a quick look and check on the amount of traffic coming into and out of the planning area at the cordon stations indicated. *The highlighted area requires an input from the Computer Synthesized Balance Through Trip Matrix.

Cordon Station 1
US 701 North
ADT 9,900

to Sta.	# Veh.	% Veh.
2	717	7.2
3	290	2.9
4	327	3.3
5	1548	15.6
6	117	1.2
7	944	9.5
8	4	0.0
9	6	0.1
10	6	0.1
11	1	0.0
12	1	0.0
Total:	3,961	40.0

Total Thru Trip Ends:	3,961	40.0
Trip Ends Remaining:	5,939	60.0

Cordon Station 3
US 74/76 Bus. East
ADT 8,600

to Sta.	# Veh.	% Veh.
1	290	3.4
2	174	2.0
4	138	1.6
5	300	3.5
6	285	3.3
7	279	3.2
8	20	0.2
9	29	0.3
10	28	0.3
11	3	0.0
12	0	0.0
Total:	1,546	18.0

Total Thru Trip Ends:	1,546	18.0
Trip Ends Remaining:	7,054	82.0

Cordon Station 5
US 701 South
ADT 9,600

to Sta.	# Veh.	% Veh.
1	1548	16.1
2	685	7.1
3	300	3.1
4	334	3.5
6	105	1.1
7	854	8.9
8	4	0.0
9	5	0.1
10	5	0.1
11	1	0.0
12	1	0.0
Total:	3,842	40.0

Total Thru Trip Ends:	3,842	40.0
Trip Ends Remaining:	5,758	60.0

Cordon Station 2
US 74/76 East
ADT 7,300

to Sta.	# Veh.	% Veh.
1	717	9.8
3	174	2.4
4	225	3.1
5	685	9.4
6	70	1.0
7	1,039	14.2
8	3	0.0
9	4	0.1
10	4	0.1
11	0	0.0
12	0	0.0
Total:	2,921	40.0

Total Thru Trip Ends:	2,921	40.0
Trip Ends Remaining:	4,379	60.0

Cordon Station 4
NC 130 South
ADT 8,500

to Sta.	# Veh.	% Veh.
1	327	3.8
2	225	2.6
3	138	1.6
5	334	3.9
6	164	1.9
7	319	3.8
8	3	0.0
9	4	0.0
10	4	0.0
11	0	0.0
12	0	0.0
Total:	1,518	17.9

Total Thru Trip Ends:	1,518	17.9
Trip Ends Remaining:	6,982	82.1

Cordon Station 6
US 74/76 Bus./NC 130 West
ADT 6,200

to Sta.	# Veh.	% Veh.
1	117	1.9
2	70	1.1
3	285	4.6
4	164	2.6
5	105	1.7
7	150	2.4
8	8	0.1
9	12	0.2
10	12	0.2
11	1	0.0
12	0	0.0
Total:	924	14.9

Total Thru Trip Ends:	924	14.9
Trip Ends Remaining:	5,276	85.1

1994 THRU TRIP ASSIGNMENT WORKSHEET - Page 2 of 2

Cordon Station 7
US 74/76 West
ADT 9,000

to Sta.	# Veh.	% Veh.
1	944	10.5
2	1039	11.5
3	279	3.1
4	319	3.5
5	854	9.5
6	150	1.7
8	4	0.0
9	5	0.1
10	5	0.1
11	0	0.0
12	0	0.0
Total:	3,599	40.0

Total Thru Trip Ends:	3,599	40.0
Trip Ends Remaining:	5,401	60.0

Cordon Station 9
SR 1166
ADT 2,800

to Sta.	# Veh.	% Veh.
1	6	0.2
2	4	0.1
3	29	1.0
4	4	0.1
5	5	0.2
6	12	0.4
7	5	0.2
8	2	0.1
10	2	0.1
11	0	0.0
12	0	0.0
Total:	69	2.5

Total Thru Trip Ends:	69	2.5
Trip Ends Remaining:	2,731	97.5

Cordon Station 11
SR 1552
ADT 800

to Sta.	# Veh.	% Veh.
1	1	0.1
2	0	0.0
3	3	0.4
4	0	0.0
5	1	0.1
6	1	0.1
7	0	0.0
8	0	0.0
9	0	0.0
10	0	0.0
12	0	0.0
Total:	6	0.8

Total Thru Trip Ends:	6	0.8
Trip Ends Remaining:	794	99.3

Cordon Station 8
SR 1170
ADT 2,000

to Sta.	# Veh.	% Veh.
1	4	0.2
2	3	0.2
3	20	1.0
4	3	0.2
5	4	0.2
6	8	0.4
7	4	0.2
9	2	0.1
10	2	0.1
11	0	0.0
12	0	0.0
Total:	50	2.5

Total Thru Trip Ends:	50	2.5
Trip Ends Remaining:	1,950	97.5

Cordon Station 10
SR 1429
ADT 2,700

to Sta.	# Veh.	% Veh.
1	6	0.2
2	4	0.1
3	28	1.0
4	4	0.1
5	5	0.2
6	12	0.4
7	5	0.2
8	2	0.1
9	2	0.1
11	0	0.0
12	0	0.0
Total:	68	2.5

Total Thru Trip Ends:	68	2.5
Trip Ends Remaining:	2,632	97.5

Cordon Station 12
SR 1549
ADT 380

to Sta.	# Veh.	% Veh.
1	1	0.3
2	0	0.0
3	0	0.0
4	0	0.0
5	1	0.3
6	0	0.0
7	0	0.0
8	0	0.0
9	0	0.0
10	0	0.0
11	0	0.0
Total:	2	0.5

Total Thru Trip Ends:	2	0.5
Trip Ends Remaining:	378	99.5

TOTAL ADT:	67,780	%		
Total Thru Trips:	18,506	27.3	(Total of all thru trips)	-1337
Trip Ends Remaining:	30,768	45.4	(Total external trips remaining)	
Thru Trip Check:	37,012		(Total trip ends)	
Trips Remaining:	15,384			

1994 SUMMARY OF TRIPS

This worksheet gives a summary of the traffic flow totals into the cordon stations and each zone. It also gives the Synthesis balanced thru trip matrix.

CORDON STA. ROUTE	AVERAGE DAILY TRAFFIC	THRU TRIP ENDS	EXTERNAL TRIPS	IE TRIPS	E-I TRIPS
1. US 701 North	9900	7922	1978	1,034	944
2. US 74/76 BYP E.	7300	5842	1458	804	654
3. US 74/76 BUS E.	8600	3092	5508	1,144	4,364
4. NC 130 SE	8500	3036	5464	975	4,489
5. US 701 South	9600	7684	1916	1,198	718
6. US 74/76 BUS W.	6200	1848	4352	1,052	3,300
7. US 74/76 BYP W.	9000	7198	1802	944	858
8. SR 1170	2000	100	1900	194	1,706
9. SR 1166	2800	138	2662	203	2,459
10. SR 142	2700	136	2564	431	2,133
11. SR 1552	800	12	788	201	587
12. SR 1549	380	4	376	115	261
TOTALS:	67780	37012	30768	8,295	22,473

ZONE	II TRIPS	IE TRIPS	E-I TRIPS
I	2,539	786	202
II	2,549	801	375
III	4,379	1,314	3,650
IV	3,207	948	621
V	2,910	703	1,401
VI	2,653	848	377
VII	5,294	1,206	3,717
VIII	1,768	249	2,921
IX	2,816	575	4,306
X	4,049	864	4,905
Totals:	32,165	8,295	22,473

1994 SYNTH DATA UNFOLDED THRU TRIP MATRIX OUTPUT

	1	2	3	4	5	6	7	8	9	10	11	12
1	0	717	290	327	1548	117	944	4	6	6	1	1
2	717	0	174	225	685	70	1039	3	4	4	0	0
3	290	174	0	138	300	285	279	20	29	28	3	0
4	327	225	138	0	334	164	319	3	4	4	0	0
5	1548	685	300	334	0	105	854	4	5	5	1	1
6	117	70	285	164	105	0	150	8	12	12	1	0
7	944	1039	279	319	854	150	0	4	5	5	0	0
8	4	3	20	3	4	8	4	0	2	2	0	0
9	6	4	29	4	5	12	5	2	0	2	0	0
10	6	4	28	4	5	12	5	2	2	0	0	0
11	1	0	3	0	1	1	0	0	0	0	0	0
12	1	0	0	0	1	0	0	0	0	0	0	0
TOTALS:	3961	2921	1546	1518	3842	924	3599	50	69	68	6	2

1994 TRAFFIC CALIBRATION

	PT. 1	PT. 2	PT. 4	PT. 6	PT. 7	PT. 8	PT. 9	PT. 13	PT. 15	PT.18	PT. 19	PT. 22	PT. 24	PT. 25	PT. 26	row totals
Thru Trips	5161	2384	6482	1163	1322	7840	2188	6480	10	138	20	42	2410	164	5668	41472
Internal/External Trips	546	522	2040	767	1543	1623	1141	1060	296	524	488	516	992	239	804	13100
External/Internal Trips	566	635	2911	1952	4290	3998	3434	880	647	1209	1031	1306	3104	405	654	27021
Internal/Internal Trips	166	57	3988	2908	9984	1136	2131	51	1344	3370	2885	476	4375	831	0	33702
Total Trips:	6439	3597	15422	6789	17139	14597	8895	8470	2297	5240	4424	2341	10880	1638	7126	115295
Average Daily Trips	5900	3800	14200	6900	17300	13400	8100	9400	2300	5300	4600	2600	10500	1500	7300	113100
DIFFERENCE between ADT's & Total Trips:	539	-203	1222	-111	-161	1197	795	-930	-3	-60	-176	-259	380	138	-174	2195
	GOOD	GOOD	GOOD	GOOD	GOOD	GOOD	GOOD	GOOD	GOOD	GOOD	GOOD	GOOD	GOOD	GOOD	GOOD	GOOD
+ 10% Range	6490	4180	15620	7590	19030	14740	8910	10340	2530	5830	5060	2860	11550	1650	8030	124410
- 10% Range	5310	3420	12780	6210	15570	12060	7290	8460	2070	4770	4140	2340	9450	1350	6570	101790

2020 TRIP GENERATION WORKSHEET - Page 1 of 3

The Trip Generation Worksheet calculates the trips generated within the planning area. It also allocates trips to the proper traffic flow totals (ie. Internal>External trips, Internal<>Internal trips) in order to develop trip tables and make assignments to the existing street system. *The highlighted areas require an input.

Step 1: Estimate the trips generated by the population and development within the future planning area. Population is converted into dwelling units and then multiplied by the trip generation rate. Commercial automobile and truck trips are then estimated and added to this total.

Population Projections		
2020 Population of Whiteville:		7,587
2020 Population of Brunswick:		413
	Total:	8,000

DWELLING UNIT TRIPS		
2020 Brunswick & W'ville Population (POP):	8,000	
1994-2020 Growth Factor (GR):	1.00	%
2020 Trip Generation Factor/DU (DUTG):	8.00	
2020 Whiteville City Person/DU (PDU):	2.05	
2020 Planning Area Population:	12,402	
2020 # DU's in Planning Area:	6,050	

The 2020 Trip Generation Factor/DU is slightly higher than that used for 1994 to take into account the historic trends. The values for persons/DU were based on the Office of State Budget and Management 2020 values for population and housing. The number of houses outside the city limits was taken from the 1987 USGS quad maps and projected to 1994 (see the 1994 Trip Generation worksheet.) The 2020 planning area population was obtained by multiplying the total number of houses outside the city limits, but within the planning area, (Hc) by the number of person/DU and adding the product to the Whiteville/Brunswick population. The total number of DU's in the planning area was obtained by dividing the total city population by the number of persons/DU and adding this number to the total number of rural DU's.

TABLE 1 gives a breakdown of the number of Dwelling Units by zone (outside the city limits of Whiteville/Brunswick but inside the planning area) and calculates the trips generated. The number of houses outside the city limits was taken from the 1987 USGS quad maps, and are considered rural. The growth factor (GR) is used to estimate the 2020 DU's .

TABLE 2 calculates trips generated within the city limits from the population and person/DU factor. The population is placed into traffic zones by percentages through estimation.

2020 TRIP GENERATION WORKSHEET - Page 2 of 3

TABLE 1- Rural Trip Generation				TABLE 2 - City Trip Generation				TOTAL
	# Houses outside City Limits		# Trips Gen.		Whiteville/Brunswick 1994 Population		# Trips Gen.	# DU Trips
Traffic Zone	1994 (Hc)	2020 (He)	1994 (TPrur)	Traffic Zone	% (ZPOP%)	# (ZPOP#)	1994 (TPcty)	(TPdu)
I	394	511	4,086	I	0.0	0	0	4,086
II	364	472	3,775	II	1.5	120	468	4,243
III	571	740	5,917	III	3.5	280	1,093	7,009
IV	0	0	0	IV	19.0	1,520	5,932	5,932
V	52	67	539	V	12.0	960	3,746	4,285
VI	0	0	0	VI	17.0	1,360	5,307	5,307
VII	5	6	52	VII	24.0	1,920	7,493	7,544
VIII	0	0	0	VIII	5.0	400	1,561	1,561
IX	13	17	135	IX	11.0	880	3,434	3,569
X	258	334	2,673	X	7.0	560	2,185	4,859
Totals:	1,658	2,147	17,177	Totals:	100.0	8,000	31,220	48,396

Hc = 1994 Houses estimated (See 1994 Trip Generation worksheet.)
He = 2020 Houses estimated = Hc * (1+GR)^26
ZPOP% = estimated % of city population within each zone.
ZPOP# = amount of city population within each zone = ([ZPOP%/100] * POP)
TPcty = City generated trips = ([ZPOP#/PDU] * DUTG).
TPdu= (TPrur + TPcty)

Total # DU Trips (TPdu): 48,396

COMMERCIAL TRIPS

2020 Commercial rips (TPcom)	Commercial Trip Generation Factor (CG): 0.14
6,775	(TPcom) = # of commercial trips gen. = (TPdu * CG). The 2020 Comm. Trip Gen. Factor was taken from Tech. Report 11, Table 1, using Ahoskie as the closest match to Whiteville, then adjusted per KDH.

Total # of Internal Trips by Pop. & Development (TPin): 55,172
TPin = (TPdu + TPcom).

Step 2: Internal trips are calculated. We can now calculate the number of internal trips with external destinations. The number of trips that stay in the planning area is in direct proportion to the number of employers inside the planning area compared with population. The Employment/Population Reduction Factor (EPR) is estimated using employment/population ratio and borrowed data from older studies. The EPR is multiplied by the total number of internal trips generated by Population & Development. The result is the number of internal trips which stay inside the planning area (II). The remainder trips have external destinations (IE).

2020 TRIP GENERATION WORKSHEET - Page 3 of 3

INTERNAL-EXTERNAL TRIPS

Employment/Population Ratio(s)

Employ/Pop Reduction Factor (EPR): 0.75

	Employ.	Pop.	Employ/Pop
Plan Area	5,581	12,402	0.45

INTERNAL TRIP DISTRIBUTION

# with Ext. dest. (TPi-e)	# with Int. dest. (TPi-I
13,793	41,379

TPi-e = # of internally generated trips with external destinations = (TPin-(TPin * EPR)).
TPi-I = # of internally generated trips with internal destinations = (TPin -TPi-e).
The values for population and employment are the 2020 projected values. The 2020 employment value was obtained by using the 1994 employment/population ratio and the 2020 population.

Step 3: NonHome Based Secondary trips are added to internal trips with internal destinations (II). NonHome Based Secondary trips are made by external trips (E-I which enter the planning area. The Secondary Trip Generation Factor was taken from Technical Report #11, Table 2, using Ahoski as the closest match to Whiteville (per KDH). External trips with internal destinations (E-I are computed by subtracting thru trip ends (E-E) and internally generated trips with external destinations (IE) from the external production (CADT). See the Cordon Worksheet.

SECONDARY TRIPS

Secondary Trip Generation Factor (NHB):	0.324
E-I Trips (TPe-I	43,669
NHB Secondary Trips (TPnhb):	14,149

GRAND TOTAL 2020 INTERNAL TRIPS (TPintot): 55,528

Cordon ADT (CADT):	124,722	(from CORDON)
Thru Trips (TPe-e):	33,630	(from CORDON)
External Trips:	57,462	(CADT - [TPe-e * 2])
IE Trips (TPi-e):	13,793	(from above)
E-I Trips (TPe-I	43,669	(CADT - [TPe-e * 2] - TPi-e)
II Trips (TPi-I	41,379	(from above)
NHB Trips (TPnhb):	14,149	(E-I Trips * NHB %age)

TPe-e = # of externally gen. trips with external destinations (thru trips).
TPe-I = # of externally gen. trips with internal destinations.
TPnhb = # of secondary non-home-based trips.
TPintot = total # of internal trips with internal destinations = (TPi-I + TPnhb).

2020 POPULATION PROJECTIONS

Whiteville/Brunswick Thoroughfare Plan

DESIGN YEAR 2020 PROJECTIONS

Year	Columbus County	% Change	Whiteville Township	% Change	Township as % of County	Whiteville Plan Area
1950	50,621	n/a	10,061	n/a	19.88	8,552
1960	48,973	-3.26	10,048	-0.13	20.52	8,541
1970	46,937	-4.16	9,799	-2.48	20.88	8,329
1980	51,037	8.74	10,392	6.05	20.36	8,833
1990	49,587	-2.84	10,266	-1.21	20.70	8,726
1994	50,084	1.00	10,369	1.00	20.70	8,814
2020	65,205	30.19	13,500	30.20	20.70	12,402

SUMMARY OF CENSUS & PROJECTIONS

Year	Columbus County	Whiteville	Brunswick	Planning Area
1970	46,937	4,195	206	8,329
1980	51,037	5,565	223	8,833
1990	49,587	5,078	302	8,726
1991	49,874	5,054	287	n/a
1992	50,168	5,037	306	n/a
1993	50,198	5,513	299	n/a
1994	50,084	5,690	310	8,853
2020	65,205	7,587	413	12,402

2020 PROJECTED AVERAGE DAILY TRAFFIC

Enter the Average Daily Traffic at all of the cordon stations and internal count stations here. Design year 2020 Average Daily Traffic will be calculated using trend analysis. This is an input worksheet for the Thru Trip calculation and distribution, and the External Trips distribution. (See the Summary of Trips, Cordon, and Trip Distribution worksheets.) *The highlighted areas require an input.

AVERAGE DAILY TRAFFIC AT CORDON STATIONS

STA.	ROUTE	1960	1970	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	Base Yr ADT 1994	GROWTH TREND CALC. (%)	GROWTH TREND USED (%)	Design Yr ADT 2020
1.	US 701 North	2950	4300	6400	7000	2800	7400	7400	7800			8400			9,900	3.50	3.00	21350
2.	US 74/76 BYP E.			4800	6400	6000	5000	5400	6190	6333	6500	6700	7000	7100	7,300	3.10	2.50	13872
3.	US 74/76 BUS E.	6000	6600										9000	8600	8,600	1.20	2.50	16343
4.	NC 130 SE			4500	4500	4600	4600	4600	4600	4700	5000	5500	6900	7500	7,500	4.60	2.00	12551
5.	US 701 South														9,600	1.00	2.30	17340
6.	US 74/76 BUS W.			4900	8000	5200	4800	4800	5100		4600	5600	5600	6200	8,200	1.00	2.00	10375
7.	US 74/76 BYP W.			5200	7000							5100	10800	8400	7,200	3.00	2.50	13682
8.	SR 1170	380	750	400		1300		600		1600		2400		2000	2,000	4.60	4.60	6440
9.	SR 1166		1800	2000		2400		2100		1800		2400		2800	2,800	1.40	1.40	4019
10.	SR 1429			350		500		1700		800		2700		2700	2,700	23.10	3.10	5972
11.	SR 1552			600		600		300		700		650		800	800	3.70	3.70	2057
12.	SR 1549		160	250		300				400		350		380	380	4.10	2.50	722

Total Design Year ADT: 124,722

AVERAGE DAILY TRAFFIC AT INTERNAL COUNT STATIONS

STA.	ROUTE	1960	1970	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	Base Yr ADT 1994	GROWTH TREND CALC. (%)	GROWTH TREND USED (%)	Design Yr ADT 2020
1.	US 701 BYP. S. of US 701N	1450	2900	4300	4800	4700	4100	4200	4500	5200				5400	5900	3.80	3.20	13382
2.	US 701 BUS. S. of US 701N	1600	2400	2800	2900	2600	2600	3000	3100	3000	2000	3300	3600	4400	3800	2.10	3.10	8404
4.	US 701 BYP. S. of US 74/76 BU	3750	7500	8200	8000	9000	12500	13100	14000	14000	11400	12500	13900	15000	14200	3.90	2.60	27677
6.	US 701 BUS. S. of US 74/76 B	6700	7500	6300		7000		6600		7800	7800	6600	7800	6800	6900	0.10	2.80	14147
7.	US 701 BUS. S. of SR 1916/19	5300	8700	13000	15000	16000	14000	14600	16100	14300	19000	15800	18700	16100	17300	3.60	2.00	28950
8.	US 701 S. of SR 1429	4250	7300	10000	10700		11800	10300	11700	11700	11700	12200	12600	13400	13400	3.20	2.50	25464
9.	NC 130 S., N of Brunswick				6900	6800	7000	6600	7500			8100	8800	9600	8100	3.80	2.40	15007
13.	US 74/76 BYP. E. of SR 1585			5200	7000							5100	10800	8400	9400	3.60	2.20	16552
15.	SR 1552 W. of SR 1551	630	900	1500		1800		1900		2200		2900		2300	2300	4.50	1.50	3387
18.	SR 1953 N. of Lewis St.		2700	4400		4700		5000		5500		4300		5300	5300	2.90	2.20	9333
19.	SR 1916 N. of Burkhead St.			3900	6600	4800	6500	4800	7100			6000		4800	4600	0.60	2.30	8309
22.	SR 1429 E. of SR 1434		580	1400		1800		1700		2200		2200		2600	2600	6.70	2.00	4351
24.	US 74/76 BUS. E. of SR 1916	6000	8900	9100	11000	11500	11600	11500	11300	12100	12000	10700	9600	8900	10500	1.60	2.10	18024
25.	SR 1920		620	750		1000		1100		1300		1200		1500	1500	3.90	2.50	2850
26.	US 74/76 BYP. ATR Station			4800	6400	6000	5000	5400	6190	8333	8500	6700	7000	7100	7300	3.10	2.50	13872

Total Design Year ADT: 209,710

2020 TRIP DISTRIBUTION WORKSHEET - Page 1 of 4

Step 4: This worksheet allocates the traffic flow grand totals to zones using trip tables. (Traffic flow grand totals were calculated in the Trip Generation worksheet.) The grand total is divided between the zones. The total trips in each zone are calculated below. The engineer must first determine the percentages, instead of numbers, from station/zone to zone/station (depending on which traffic flow total you are working on). Using percentages will help keep the traffic flow ie, station to zone on the right course. *The highlighted areas require an input.

Zone No.	Trips Generated by Pop. & Development DU Trips (TPdu)	Comm. Trips (TPcomm)	Total (TPin)	# Trips w/ ext. dest. (TPi-e)	int. dest. (TPi-I	(SEC) NHB Trips (TPnhb)
I	4,086	572	4,658	1,165	3,494	354
II	4,243	594	4,838	1,209	3,628	283
III	7,009	981	7,991	1,998	5,993	849
IV	5,932	830	6,762	1,691	5,072	707
V	4,285	600	4,885	1,221	3,664	1,556
VI	5,307	743	6,050	1,513	4,538	212
VII	7,544	1,056	8,601	2,150	6,451	3,254
VIII	1,561	219	1,780	445	1,335	1,981
IX	3,569	500	4,068	1,017	3,051	2,122
X	4,859	680	5,539	1,385	4,154	2,830
Total:	48,396	6,775	55,172	13,793	41,379	14,149

TPdu = TPrur + TPcty
TPcom = TPdu * C (CG = 0.14 Commercial Gen Factor)
TPin = TPdu + TPcom
TPi-e = TPin * EPR (EPR = 0.75, Employ/Pop Reduction Factor)
TPi-I = TPin - TPi-e

INTERNAL-EXTERNAL

The Internal-External (IE) trip table allocates percentages from zones to stations, for means of obtaining traffic coming into that zone from an external destination. Next these trips will placed on internal stations which they would likely encounter while traveling from a certain zone to station.

IE TRIPS (%)	From Zone	Trips	% IE Trips (from zone to station) to cordon sta. 1	2	3	4	5	6	7	8	9	10	11	12	Total
	I	1,165	16.0	16.0	0.0	12.0	19.0	14.0	12.0	1.0	3.0	1.0	3.0	3.0	100.0
	II	1,209	16.0	20.0	8.0	9.0	10.0	14.0	8.0	0.0	3.0	11.0	1.0	0.0	100.0
	III	1,998	10.0	9.0	10.0	18.0	10.0	10.0	12.0	10.0	3.0	5.0	1.0	2.0	100.0
	IV	1,691	18.0	1.0	18.0	10.0	18.0	15.0	13.0	1.0	1.0	2.0	3.0	0.0	100.0
	V	1,221	10.0	10.0	17.5	10.0	15.0	14.5	15.0	0.0	2.0	3.0	3.0	0.0	100.0
	VI	1,513	10.0	10.0	28.0	12.5	15.0	10.0	12.0	0.0	0.0	0.0	2.5	0.0	100.0
	VII	2,150	10.0	9.0	14.0	12.0	20.0	15.0	10.0	0.0	2.0	5.0	2.0	1.0	100.0
	VIII	445	12.0	0.0	20.0	12.0	16.0	11.0	12.0	3.0	2.0	2.0	5.0	5.0	100.0
	IX	1,017	12.0	10.0	12.0	10.0	10.0	10.0	12.0	2.0	2.0	12.0	4.0	4.0	100.0
	X	1,385	12.0	8.0	15.0	8.0	11.0	12.0	9.0	3.0	6.0	11.0	3.0	2.0	100.0
	Total:	13,793													

IE TRIPS (#)

From Zone	Trips	# IE Trips (from zone to station) to cordon sta. 1	2	3	4	5	6	7	8	9	10	11	12	Total
I	1,165	186	186	0	140	221	163	140	12	35	12	35	35	1164.5
II	1,209	194	242	97	109	121	169	97	0	36	133	12	0	1209.4
III	1,998	200	180	200	360	200	200	240	200	60	100	20	40	1997.7
IV	1,691	304	17	304	169	304	254	220	17	17	34	51	0	1690.5
V	1,221	122	122	214	122	183	177	183	0	24	37	37	0	1221.3
VI	1,513	151	151	424	189	227	151	182	0	0	0	38	0	1512.6
VII	2,150	215	194	301	258	430	323	215	0	43	108	43	22	2150.2
VIII	445	53	0	89	53	71	49	53	13	9	9	22	22	444.9
IX	1,017	122	102	122	102	102	102	122	20	20	122	41	41	1017.1
X	1,385	166	111	208	111	152	166	125	42	83	152	42	28	1384.8
Total:	13,793	1714	1304	1958	1612	2012	1753	1576	304	328	706	340	187	13,793

INTERNAL-INTERNAL

The Internal-Internal (II) trip table allocates percentages from zones to zones, for means of obtaining traffic traveling internally from one zone to another zone. Next these trips will placed on internal stations which they would likely encounter while traveling from zone to zone.

II TRIPS (%)

The number of II trips includes secondary trips.

From Zone	Trips	% II Trips (from zone to zone) to zone no. I	II	III	IV	V	VI	VII	VIII	IX	X	Total
I	3,847	4.0	2.0	5.0	9.0	7.0	2.0	24.0	10.0	18.0	19.0	100.0
II	3,911	2.0	4.0	15.0	7.0	8.0	3.0	20.0	10.0	15.0	16.0	100.0
III	6,842	1.0	2.0	5.0	6.0	7.0	2.0	25.0	15.0	15.0	22.0	100.0
IV	5,779	1.0	1.0	10.0	4.0	8.0	2.0	18.0	18.0	18.0	20.0	100.0
V	5,220	2.0	1.0	20.0	10.0	4.0	1.0	21.0	12.0	10.0	19.0	100.0
VI	4,750	2.0	1.0	5.0	8.0	7.0	4.0	17.0	20.0	18.0	18.0	100.0
VII	9,705	1.5	1.0	6.0	6.0	9.0	2.5	23.0	14.0	18.0	19.0	100.0
VIII	3,315	1.0	1.0	5.0	10.0	9.0	2.0	20.0	10.0	22.0	20.0	100.0
IX	5,174	1.0	1.0	9.5	10.0	9.0	1.0	20.0	10.0	10.0	28.5	100.0
X	6,984	0.5	2.0	12.5	6.0	6.0	1.0	22.0	15.0	20.0	15.0	100.0
Total:	55,528											

2020 TRIP DISTRIBUTION WORKSHEET - Page 3 of 4

II TRIPS (#)

The number of II trips includes secondary trips.

From Zone	Trips	# II Trips (from zone to zone) to zone no. I	II	III	IV	V	VI	VII	VIII	IX	X	Total
I	3,847	154	77	192	346	269	77	923	385	693	731	3847
II	3,911	78	156	587	274	313	117	782	391	587	626	3911
III	6,842	68	137	342	411	479	137	1710	1026	1026	1505	6842
IV	5,779	58	58	578	231	462	116	1040	1040	1040	1156	5779
V	5,220	104	52	1044	522	209	52	1096	626	522	992	5220
VI	4,750	95	47	237	380	332	190	807	950	855	855	4750
VII	9,705	146	97	582	582	873	243	2232	1359	1747	1844	9705
VIII	3,315	33	33	166	332	298	66	663	332	729	663	3315
IX	5,174	52	52	492	517	466	52	1035	517	517	1475	5174
X	6,984	35	140	873	419	419	70	1536	1048	1397	1048	6984
Total:	55,528	823	849	5093	4014	4121	1119	11826	7674	9113	10894	55528

EXTERNAL-INTERNAL

The External-Internal (E-I trip table allocates percentages from stations to zones, for means of obtaining traffic coming from an external destination outside the planning area to a zone. Next these trips will placed on internal stations which they would likely encounter while traveling from a certain station to a zone.

E-I TRIPS

Cordon Sta.	ADT	Thru Trip	External Trips	IE Trips	E-I Trips
1	21,350	17,080	4,270	1,714	2,556
2	13,872	11,125	2,747	1,304	1,442
3	16,343	5,851	10,492	1,958	8,534
4	12,551	4,418	8,133	1,612	6,520
5	17,340	13,872	3,468	2,012	1,456
6	10,375	3,113	7,263	1,753	5,509
7	13,682	10,946	2,736	1,576	1,161
8	6,440	335	6,105	304	5,801
9	4,019	193	3,826	328	3,499
10	5,972	287	5,685	706	4,979
11	2,057	33	2,025	340	1,685
12	722	9	713	187	526
Totals:	124,722	67,260	57,462	13,793	43,669

E-I TRIPS (%)

From Station	Trips	% E-I Trips (from station to zone) to zone no. I	II	III	IV	V	VI	VII	VIII	IX	X	Total
1	2,556	3.0	1.0	13.0	3.0	6.0	2.0	22.0	16.0	16.0	18.0	100.0
2	1,442	2.5	1.5	4.0	3.0	12.0	2.0	24.0	5.0	24.0	22.0	100.0
3	8,534	0.0	1.5	2.0	3.0	6.0	3.0	18.0	25.0	21.5	20.0	100.0
4	6,520	0.5	1.0	25.0	3.0	2.0	0.0	12.0	13.0	17.0	26.5	100.0
5	1,456	1.0	2.0	4.0	4.0	9.0	1.0	20.0	10.0	22.0	27.0	100.0
6	5,509	2.0	3.0	3.0	3.0	12.0	4.0	24.0	15.0	18.0	16.0	100.0
7	1,161	2.0	2.0	3.0	3.0	10.0	2.0	27.0	14.0	19.0	18.0	100.0
8	5,801	0.0	0.0	98.0	0.0	0.0	0.0	0.0	0.0	1.0	1.0	100.0
9	3,499	1.0	2.0	4.0	4.0	10.0	1.0	22.0	7.0	22.0	27.0	100.0
10	4,979	0.0	3.0	15.0	1.0	2.0	0.5	5.0	5.0	30.0	38.5	100.0
11	1,685	2	0	5	4	10	3	25	12	21	18	100.0
12	526	3	0.5	7	4	8	2	25.5	10	23	17	100.0
Total:	43,669											

E-I TRIPS (#)

From Station	Trips	# E-I Trips (from station to zone) to zone no. I	II	III	IV	V	VI	VII	VIII	IX	X	Total
1	2,556	77	26	332	77	153	51	562	409	409	460	2556
2	1,442	36	22	58	43	173	29	346	72	346	317	1442
3	8,534	0	128	171	256	512	256	1536	2134	1835	1707	8534
4	6,520	33	65	1630	196	130	0	782	848	1108	1728	6520
5	1,456	15	29	58	58	131	15	291	146	320	393	1456
6	5,509	110	165	165	165	661	220	1322	826	992	881	5509
7	1,161	23	23	35	35	116	23	313	162	221	209	1161
8	5,801	0	0	5685	0	0	0	0	0	58	58	5801
9	3,499	35	70	140	140	350	35	770	245	770	945	3499
10	4,979	0	149	747	50	100	25	249	249	1494	1917	4979
11	1,685	34	0	84	67	168	51	421	202	354	303	1,685
12	526	16	3	37	21	42	11	134	53	121	89	526
Total:	43,669	378	680	9,142	1,108	2,537	715	6,728	5,345	8,027	9,008	43,669

2020 THRU TRIP DISTRIBUTION WORKSHEET - Page 1 of 2

This worksheet calculates the number of vehicles from the percentage of vehicles calculated in the 1994 Thru Trip Distribution. *The highlighted area requires an input from the 1994 Thru Trip Distribution worksheet.

Cordon Station 1
US 701 North
ADT 21,350

to Sta.	# Veh.	% Veh.
2	1559	7.3
3	619	2.9
4	705	3.3
5	3331	15.6
6	256	1.2
7	2028	9.5
8	0	0.0
9	21	0.1
10	21	0.1
11	0	0.0
12	0	0.0
Total:	8,540	40.0

Total Thru Trip Ends:	8,540	40.0
Trip Ends Remaining:	12,810	60.0

Cordon Station 3
US 74/76 Bus. East
ADT 16,343

to Sta.	# Veh.	% Veh.
1	556	3.4
2	327	2.0
4	261	1.6
5	572	3.5
6	539	3.3
7	523	3.2
8	33	0.2
9	49	0.3
10	49	0.3
11	16	0.1
12	0	0.0
Total:	2,925	17.9

Total Thru Trip Ends:	2,925	17.9
Trip Ends Remaining:	13,417	82.1

Cordon Station 5
US 701 South
ADT 17,340

to Sta.	# Veh.	% Veh.
1	2792	16.1
2	1231	7.1
3	538	3.1
4	607	3.5
6	191	1.1
7	1543	8.9
8	0	0.0
9	17	0.1
10	17	0.1
11	0	0.0
12	0	0.0
Total:	6,936	40.0

Total Thru Trip Ends:	6,936	40.0
Trip Ends Remaining:	10,404	60.0

Cordon Station 2
US 74/76 East
ADT 13,872

to Sta.	# Veh.	% Veh.
1	1359	9.8
3	333	2.4
4	430	3.1
5	1304	9.4
6	139	1.0
7	1970	14.2
8	0	0.0
9	14	0.1
10	14	0.1
11	0	0.0
12	0	0.0
Total:	5,563	40.1

Total Thru Trip Ends:	5,563	40.1
Trip Ends Remaining:	8,309	59.9

Cordon Station 4
NC 130 South
ADT 12,551

to Sta.	# Veh.	% Veh.
1	477	3.8
2	326	2.6
3	201	1.6
5	489	3.9
6	238	1.9
7	477	3.8
8	0	0.0
9	0	0.0
10	0	0.0
11	0	0.0
12	0	0.0
Total:	2,209	17.6

Total Thru Trip Ends:	2,209	17.6
Trip Ends Remaining:	10,342	82.4

Cordon Station 6
US 74/76 Bus./NC 130 West
ADT 10,375

to Sta.	# Veh.	% Veh.
1	197	1.9
2	114	1.1
3	477	4.6
4	270	2.6
5	176	1.7
7	249	2.4
8	10	0.1
9	21	0.2
10	21	0.2
11	21	0.2
12	0	0.0
Total:	1,556	15.0

Total Thru Trip Ends:	1,556	15.0
Trip Ends Remaining:	8,819	85.0

2020 THRU TRIP DISTRIBUTION WORKSHEET - Page 2 of 2

Cordon Station 7
US 74/76 West
ADT 13,682

to Sta.	# Veh.	% Veh.
1	1437	10.5
2	1573	11.5
3	424	3.1
4	479	3.5
5	1300	9.5
6	233	1.7
8	0	0.0
9	14	0.1
10	14	0.1
11	0	0.0
12	0	0.0
Total:	5,473	40.0

Total Thru Trip Ends:	5,473	40.0
Trip Ends Remaining:	8,209	60.0

Cordon Station 9
SR 1166
ADT 4,019

to Sta.	# Veh.	% Veh.
1	8	0.2
2	4	0.1
3	40	1.0
4	4	0.1
5	8	0.2
6	16	0.4
7	8	0.2
8	4	0.1
10	4	0.1
11	0	0.0
12	0	0.0
Total:	96	2.4

Total Thru Trip Ends:	96	2.4
Trip Ends Remaining:	3,923	97.6

Cordon Station 11
SR 1552
ADT 2,057

to Sta.	# Veh.	% Veh.
1	2	0.1
2	0	0.0
3	8	0.4
4	0	0.0
5	2	0.1
6	2	0.1
7	2	0.1
8	0	0.0
9	0	0.0
10	0	0.0
12	0	0.0
Total:	16	0.8

Total Thru Trip Ends:	16	0.8
Trip Ends Remaining:	2,041	99.2

Cordon Station 8
SR 1170
ADT 6,440

to Sta.	# Veh.	% Veh.
1	13	0.2
2	13	0.2
3	64	1.0
4	13	0.2
5	13	0.2
6	26	0.4
7	13	0.2
9	6	0.1
10	6	0.1
11	0	0.0
12	0	0.0
Total:	167	2.6

Total Thru Trip Ends:	167	2.6
Trip Ends Remaining:	6,272	97.4

Cordon Station 10
SR 1429
ADT 5,972

to Sta.	# Veh.	% Veh.
1	12	0.2
2	6	0.1
3	60	1.0
4	6	0.1
5	12	0.2
6	24	0.4
7	12	0.2
8	6	0.1
9	6	0.1
11	0	0.0
12	0	0.0
Total:	143	2.4

Total Thru Trip Ends:	143	2.4
Trip Ends Remaining:	5,828	97.6

Cordon Station 12
SR 1549
ADT 722

to Sta.	# Veh.	% Veh.
1	2	0.3
2	0	0.0
3	0	0.0
4	0	0.0
5	2	0.3
6	0	0.0
7	0	0.0
8	0	0.0
9	0	0.0
10	0	0.0
11	0	0.0
Total:	4	0.6

Total Thru Trip Ends:	4	0.6
Trip Ends Remaining:	718	99.4

TOTAL ADT:	124,722	%	
Total Thru Trips:	33,630	27.0	(Total of all thru trips)
Trip Ends Remaining:	57,462	46.1	(Total external trips remaining)
Thru Trip Check:	67,260		(Total trip ends)
Trips Remaining:	28,731		

2020 SUMMARY OF TRIPS

This worksheet gives a summary of the traffic flow totals into the cordon stations and each zone. It also gives the Synthesis balanced thru trip matrix.

CORDON STA. ROUTE	AVERAGE DAILY TRAFFIC	THRU TRIP ENDS	EXTERNAL TRIPS	IE TRIPS	E-I TRIPS
1. US 701 North	21,350	17,080	4,270	1,714	2,556
2. US 74/76 BYP E.	13,872	11,524	2,348	1,304	1,044
3. US 74/76 BUS E.	16,343	1,929	14,413	1,958	12,456
4. NC 130 SE	12,551	4,682	7,869	1,612	6,256
5. US 701 South	17,340	13,792	3,547	2,012	1,535
6. US 74/76 BUS W.	10,375	2,298	8,077	1,753	6,324
7. US 74/76 BYP W.	13,682	12,596	1,086	1,576	(489)
8. SR 1170	6,440	47	6,393	304	6,089
9. SR 1166	4,019	196	3,824	328	3,496
10. SR 142	5,972	196	5,776	706	5,070
11. SR 1552	2,057	42	2,016	340	1,676
12. SR 1549	722	0	722	187	535
TOTALS:	124,722	64,381	60,341	13,793	46,548

ZONE	II TRIPS	IE TRIPS	E-I TRIPS
I	3,847	1,165	378
II	3,911	1,209	680
III	6,842	1,998	9,142
IV	5,779	1,691	1,108
V	5,220	1,221	2,537
VI	4,750	1,513	715
VII	9,705	2,150	6,728
VIII	3,315	445	5,345
IX	5,174	1,017	8,027
X	6,984	1,385	9,008
Totals:	55,528	13,793	43,669

2020 SYNTH DATA UNFOLDED THRU TRIP MATRIX OUTPUT

	1	2	3	4	5	6	7	8	9	10	11	12
1	0	1559	619	705	3331	256	2028	0	21	21	0	0
2	1559	0	333	430	1304	139	1970	0	14	14	0	0
3	619	333	0	2	4	3	3	0	0	0	0	0
4	705	430	2	0	489	238	477	0	0	0	0	0
5	3331	1304	4	489	0	191	1543	0	17	17	0	0
6	256	139	3	238	191	0	249	10	21	21	21	0
7	2028	1970	3	477	1543	249	0	0	14	14	0	0
8	0	0	0	0	0	10	0	0	6	6	0	0
9	21	14	0	0	17	21	14	6	0	4	0	0
10	21	14	0	0	17	21	14	6	4	0	0	0
11	0	0	0	0	0	21	0	0	0	0	0	0
12	0	0	0	0	0	0	0	0	0	0	0	0
TOTALS:	8540	5762	965	2341	6896	1149	6298	23	98	98	21	0

2020 TRAFFIC CALIBRATION

	PT. 1	PT. 2	PT. 4	PT. 6	PT. 7	PT. 8	PT. 9	PT. 13	PT. 15	PT.18	PT. 19	PT. 22	PT. 24	PT. 25	PT. 26	row totals
Thru Trips	10223	2993	11524	2217	2262	13223	3241	13171	0	2	44	80	1098	352	11191	71620
Internal/External Trips	891	1091	3337	1312	2595	2697	1849	2311	481	907	827	642	1730	390	1304	22364
External/Internal Trips	1358	1640	5107	4150	7760	7062	5414	-374	1694	2845	2221	2860	6837	775	1044	50393
Internal/Internal Trips	1923	2467	6935	5136	15682	1879	3478	205	1370	5075	4796	741	7752	1601	0	59039
Total Trips:	14395	8190	26903	12815	28299	24862	13981	15313	3545	8829	7888	4323	17416	3118	13539	203416
Growth Rate calculated	3.49	3.00	2.49	2.41	1.91	2.41	2.12	1.89	1.68	1.98	2.10	1.97	1.97	2.85	2.40	
Projected ADT's	13382	8404	27677	14147	28950	25464	15007	16552	3387	9333	8309	4351	18024	2850	13872	209710
Growth Rate calculated	3.20	3.10	2.60	2.80	2.00	2.50	2.40	2.20	1.50	2.20	2.30	2.00	2.10	2.50	2.50	
DIFFERENCE between ADT's & Total Trips:	1013	-214	-774	-1332	-651	-602	-1026	-1239	158	-503	-420	-28	-608	267	-333	-6294
	GOOD	GOOD	GOOD	GOOD	GOOD	GOOD	GOOD	GOOD	GOOD	GOOD	GOOD	GOOD	GOOD	GOOD	GOOD	GOOD
+ 10% Range	14720	9245	30445	15562	31845	28010	16507	18207	3726	10266	9139	4786	19827	3135	15259	230681
- 10% Range	12044	7564	24909	12732	26055	22918	13506	14897	3049	8399	7478	3916	16222	2565	12485	188739

APPENDIX C

APPENDIX C

TYPICAL THOROUGHFARE CROSS SECTIONS

Cross section requirements for thoroughfares vary according to the desired capacity and level of service to be provided. Universal standards in the design of thoroughfares are not practical. Each street section must be individually analyzed and its cross section requirements determined on the basis of amount and type of projected traffic, existing capacity, desired level of service, and available right-of-way.

Typical cross section recommendations are shown in Figure C1. These cross sections are typical for facilities on new location and where right-of-way constraints are not critical. For widening projects and urban projects with limited right-of-way, special cross sections should be developed that meet the needs of the project.

Recommended typical cross sections for thoroughfares were derived on the basis of projected traffic, existing capacities, desirable levels of service, and available right-of-way. The recommended typical cross sections for the thoroughfares are given in Appendix A along with other pertinent information.

On all existing and proposed major thoroughfares delineated on the thoroughfare plan, adequate right-of-way should be protected or acquired for the ultimate cross sections. Ultimate desirable cross sections for each of the thoroughfares are listed in Appendix A. Recommendations for "ultimate" cross sections are provided for (1) thoroughfares which may require widening after the current planning period; (2) for thoroughfares which are borderline adequate and accelerated traffic growth could render them deficient; and (3) for thoroughfares where an urban curb and gutter cross section may be locally desirable because of urban development or redevelopment.

Recommended design standards relating to maximum and minimum grades, minimum sight distances, maximum degree of curve and related super elevation, and other considerations for thoroughfares are given in Appendix D. This Appendix gives definitions and design standards recommended for inclusion in subdivision regulations.

Cross sections "A" and "L" is typical for controlled access freeways. The 14 m (46 ft) grassed median is the minimum desirable median width, but there could be some variation from this depending upon design considerations. Right-of-way requirements would typically vary upward from 70 m (228 ft) depending upon cut and fill requirements.

Cross section "B", seven lane curb and gutter, should not be used for new projects. When the conditions warrant six lanes, cross section "D" should be recommended. Cross section "B" should be used only in special situations such as when widening from a five lane section and right-of-way is limited. Even in these situations, consideration should be given to converting the center turn lane to a median so that cross section "D" is the final cross section.

Cross section "C", five lane curb and gutter, is typical for major thoroughfares where frequent left turns are anticipated as a result of abutting development or frequent street intersections.

Cross sections "D", "E", and "M" are used on major thoroughfares where left turns and intersecting streets are not as frequent. Left turns would be restricted to a few selected intersections. The 4.9 m (16 ft) median is the minimum recommended for an urban

boulevard type cross section. In most instances, monolithic construction should be utilized due to greater cost effectiveness, ease and speed of placement, and reduced future maintenance requirements. In special cases, grassed or landscaped medians may be used in urban areas. However, these types of medians result in greatly increased maintenance costs and an increased danger to maintenance personnel. Non-monolithic medians should only be recommended when the above concerns are addressed.

Cross section "F" is recommended for urban boulevards or parkways to enhance the urban environment and to improve the compatibility of major thoroughfares with residential areas. A minimum median width of 7.3 m (24 ft) is recommended with 9.1 m (30 ft) being desirable.

Typical cross section "G" is recommended for major thoroughfares where projected travel indicates a need for four travel lanes but traffic is not excessively high, left turning movements are light, and right-of-way is restricted. An additional left turn lane would probably be required at major intersections. This cross section should be used only if the above criteria is met. If right-of-way is not restricted, future strip development could take place and the inner lanes could become de facto left turn lanes.

In urban environments, thoroughfares which are proposed to function as one-way traffic carriers would typically require **cross section "H". Cross sections "I" and "J"** are usually recommended for urban minor thoroughfares since these facilities usually serve both land service and traffic service functions. **Cross section "I"** would be used on those minor thoroughfares where parking on both sides is needed as a result of more intense development.

Cross section "K" is used in rural areas or for staged construction of a wider multi-lane cross section. On some thoroughfares, projected traffic volumes may indicate that two travel lanes will adequately serve travel for a considerable period of time. For areas that are growing and future widening will be necessary, the full right-of-way of 30 m (100 ft) should be required. In some instances, local ordinances may not allow the full 30 m (100 ft). In those cases, 21 m (70 ft) should be preserved with the understanding that the full 30 m (100 ft) will be preserved by use of building setbacks and future street line ordinances.

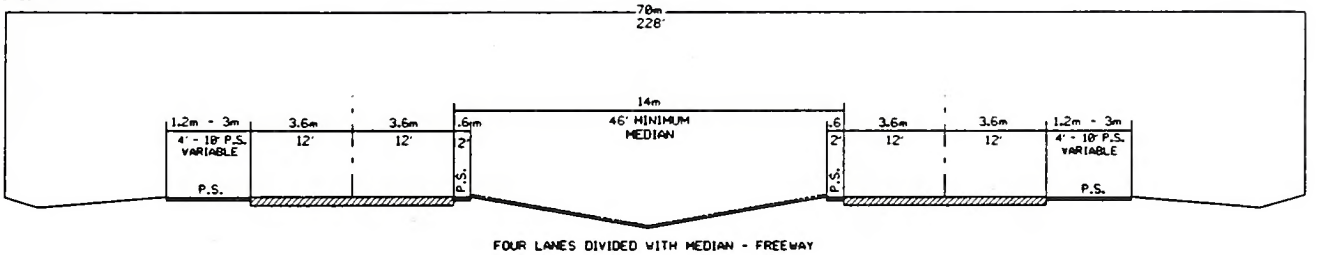
The urban curb and gutter cross sections all illustrate the sidewalk adjacent to the curb with a buffer or utility strip between the sidewalk and the minimum right-of-way line. This permits adequate setback for utility poles. If it is desired to move the sidewalk farther away from the street to provide additional separation for pedestrians or for aesthetic reasons, additional right-of-way must be provided to insure adequate setback for utility poles.

The right-of-ways shown for the typical cross sections are the minimum rights-of-way required to contain the street, sidewalks, utilities, and drainage facilities. Cut and fill requirements may require either additional right-of-way or construction easements. Obtaining construction easements is becoming the more common practice for urban thoroughfare construction.

If there is sufficient bicycle travel along the thoroughfare to justify a bicycle lane or bikeway, additional right-of-way may be required to contain the bicycle facilities. The North Carolina Bicycle Facilities Planning and Design Guidelines should be consulted for design standards for bicycle facilities. **Cross sections N, O, and P** are typically used to accommodate bicycle travel.

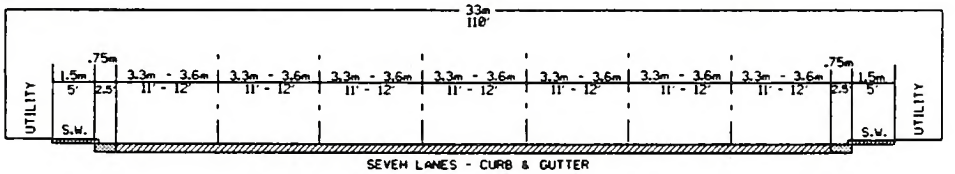
TYPICAL THOROUGHFARE CROSS SECTIONS

A.



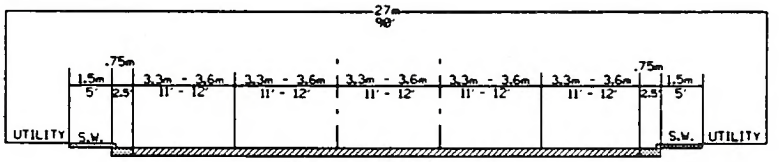
FOUR LANES DIVIDED WITH MEDIAN - FREEWAY

B.



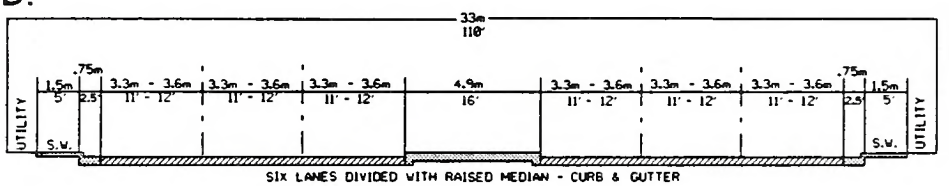
SEVEN LANES - CURB & GUTTER

C.



FIVE LANES - CURB & GUTTER

D.



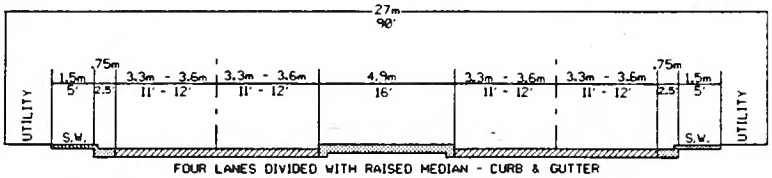
SIX LANES DIVIDED WITH RAISED MEDIAN - CURB & GUTTER

FIGURE C1

5-8-95

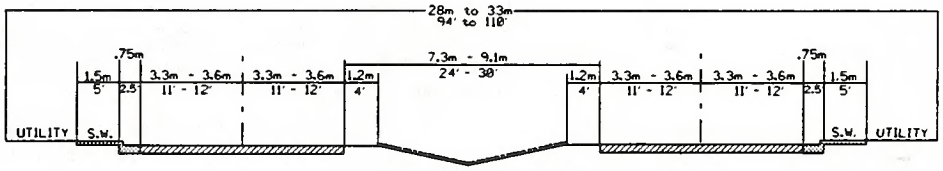
TYPICAL THOROUGHFARE CROSS SECTIONS

E.



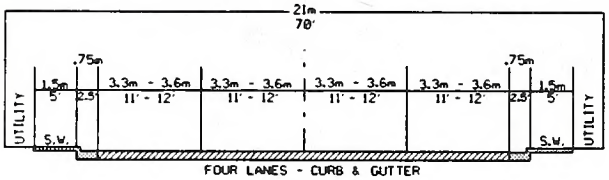
FOUR LANES DIVIDED WITH RAISED MEDIAN - CURB & GUTTER

F.



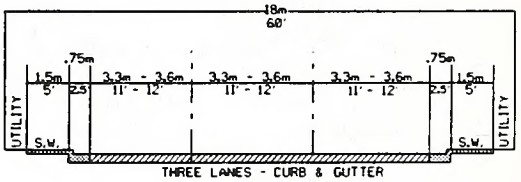
FOUR LANES DIVIDED - BOULEVARD
GRASS MEDIAN

G.



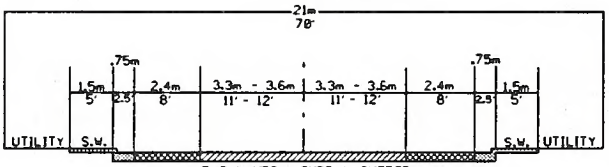
FOUR LANES - CURB & GUTTER

H.



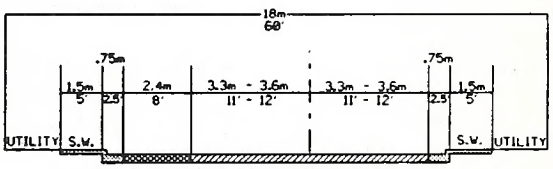
THREE LANES - CURB & GUTTER

I.



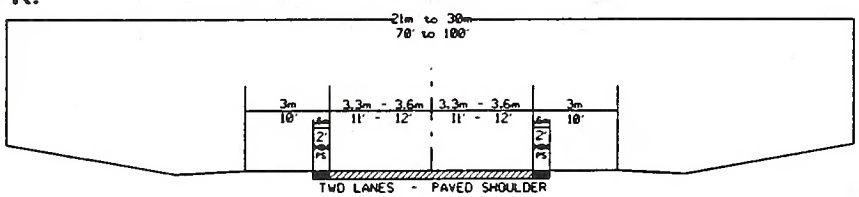
TWO LANES - CURB & GUTTER
PARKING ON EACH SIDE

J.



TWO LANES - CURB & GUTTER
PARKING ON ONE SIDE

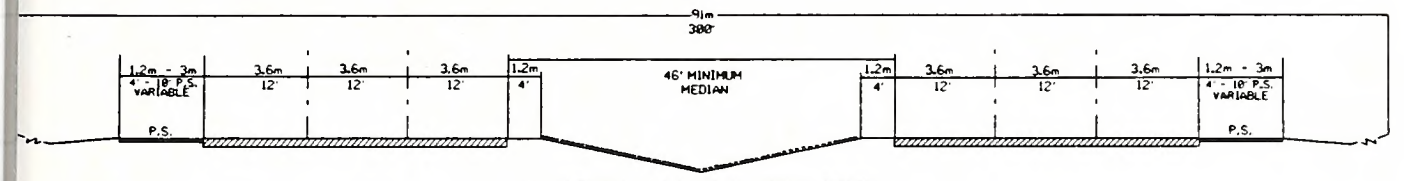
K.



TWO LANES - PAVED SHOULDER

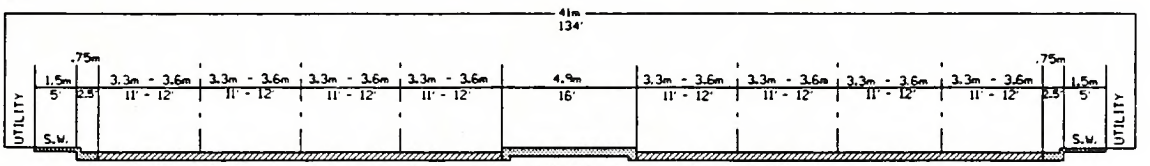
TYPICAL THOROUGHFARE CROSS SECTIONS

L.



SIX LANES DIVIDED WITH GRASS MEDIAN - FREEWAY

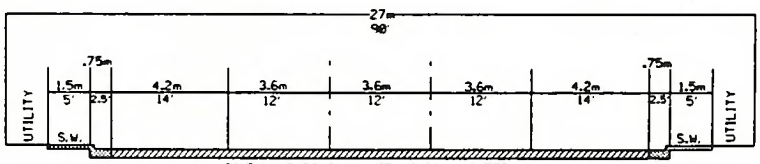
M.



EIGHT LANES DIVIDED WITH RAISED MEDIAN - CURB & GUTTER

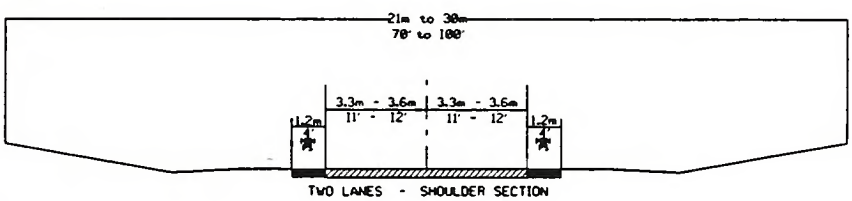
TYPICAL THOROUGHFARE CROSS SECTIONS FOR ACCOMMODATING BICYCLES

N.



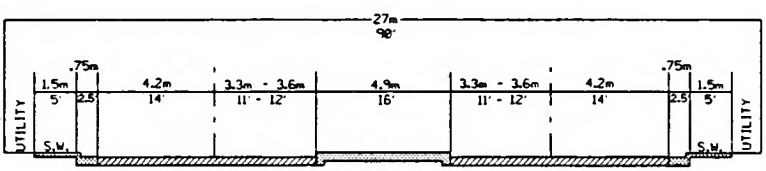
FIVE-LANE ROADWAY WITH CURB & GUTTER,
STANDARD INSIDE LANES & WIDENED CURB LANES

O.



TWO LANES - SHOULDER SECTION

P.



FOUR LANES DIVIDED WITH RAISED MEDIAN - CURB & GUTTER,
STANDARD INSIDE LANES & WIDENED CURB LANES

APPENDIX D

Appendix D

RECOMMENDED SUBDIVISION ORDINANCES

Note: English equivalents are printed in this report merely as a guide. The English measurements were not meant to represent exact conversions, and should not be used for standards, regulations, or construction. The tables in this section were taken from the Roadway Design Metric Design Manual. In the event of conflicting information, the Standard Specifications for Roads and Structures and the Roadway Design Metric Design Manual should serve as the standard.

DEFINITIONS

I. Streets and Roads

A. Rural Roads

1. Principal Arterial - A rural link in a highway system serving travel, and having characteristics indicative of substantial statewide or interstate travel and existing solely to serve traffic. This network would consist of Interstate routes and other routes designated as principal arterials.

2. Minor Arterial - A rural roadway joining cities and larger towns and providing intra-state and inter-county service at relatively high overall travel speeds with minimum interference to through movement.

3. Major Collector - A road which serves major intra-county travel corridors and traffic generators and provides access to the Arterial system.

4. Minor Collector - A road which provides service to small local communities and traffic generators and provides access to the Major Collector system.

5. Local Road - A road which serves primarily to provide access to adjacent land, over relatively short distances.

B. Urban Streets

1. Major Thoroughfares - Major thoroughfares consist of Interstate, other freeway, expressway, or parkway roads, and major streets that provide for the expeditious movement of high volumes of traffic within and through urban areas.

2. Minor Thoroughfares - Minor thoroughfares perform the function of collecting traffic from local access streets and carrying it to the major thoroughfare system. Minor thoroughfares may be used to supplement the major thoroughfare system by facilitating minor through traffic movements and may also serve abutting property.

3. Local Street - A local street is any street not on a higher order urban system and serves primarily to provide direct access to abutting land.

C. Specific Type Rural or Urban Streets

1. Freeway, expressway, or parkway - Divided multilane roadways designed to carry large volumes of traffic at high speeds. A freeway provides for continuous flow of vehicles with no direct access to abutting property and with access to selected crossroads only by way of interchanges. An expressway is a facility with full or partial control of access and generally with grade separations at major intersections. A parkway is for non-commercial traffic, with full or partial control of access.

2. Residential Collector Street - A local street which serves as a connector street between local residential streets and the thoroughfare system. Residential collector streets typically collect traffic from 100 to 400 dwelling units.

3. Local Residential Street - Cul-de-sacs, loop streets less than 760 meters (2500 ft) in length, or streets less than 1.6 kilometers (1.0 miles) in length that do not connect thoroughfares, or serve major traffic generators, and do not collect traffic from more than 100 dwelling units.

4. Cul-de-sac - A short street having only one end open to traffic and the other end being permanently terminated and a vehicular turn-around provided.

5. Frontage Road - A road that is parallel to a partial or full access controlled facility and provides access to adjacent land.

6. Alley - A strip of land, owned publicly or privately, set aside primarily for vehicular service access to the back side of properties otherwise abutting on a street.

II. Property

A. Building Setback Line - A line parallel to the street in front of which no structure shall be erected.

B. Easement - A grant by the property owner for use by the public, a corporation, or person(s), of a strip of land for a specific purpose.

C. Lot - A portion of a subdivision, or any other parcel of land, which is intended as a unit for transfer of ownership or for development or both. The word "lot" includes the words "plat" and "parcel".

III. Subdivision

A. Subdivider - Any person, firm, corporation or official agent thereof, who subdivides of develops any land deemed to be a subdivision.

B. Subdivision - All divisions of a tract or parcel of land into two or more lots, building sites, or other divisions for the purpose, immediate or future, of sale or building development and all divisions of land involving the dedication of a new street or change in existing streets; provided, however, that the following shall not be included within this definition nor subject to these regulations: (1) the combination or re-combination of portions of previously platted lots where the total number of lots is not increased and the resultant lots are equal to or exceed the standards contained herein; (2) the division of land into parcels greater than 4 hectares (10 acres) where no street right-of-way dedication is involved, (3) the public acquisition, by purchase, of strips of land for the widening or the opening of streets; (4) the division of a tract in single ownership whose entire area is no greater than 0.8 hectares (2 acres) into not more than three lots, where no street right-of-way dedication is involved and where the resultant lots are equal to or exceed the standards contained herein.

C. Dedication - A gift, by the owner, of his property to another party without any consideration being given for the transfer. The dedication is made by written instrument and is completed with an acceptance.

D. Reservation - Reservation of land does not involve any transfer of property rights. It constitutes an obligation to keep property free from development for a stated period of time.

DESIGN STANDARDS

I. Streets and Roads

The design of all roads within the Planning Area shall be in accordance with the accepted policies of the North Carolina Department of Transportation, Division of Highways, as taken or modified from the American Association of State Highway Officials' (AASHTO) manuals.

The provision of street rights-of-way shall conform and meet the recommendations of the Thoroughfare Plan, as adopted by the municipality.

The proposed street layout shall be coordinated with the existing street system of the surrounding area. Normally the proposed streets should be the extension of existing streets if possible.

A. Right-of-way Widths - Right-of-way (ROW) widths shall not be less than the following and shall apply except in those cases where ROW requirements have been specifically set out in the Thoroughfare Plan.

	Min. ROW	
1. Rural		
a. Principle Arterial		
Freeways	105 m	(350 ft)
Other	60 m	(200 ft)
b. Minor Arterial	30 m	(100 ft)
c. Major Collector	30 m	(100 ft)
d. Minor Collector	24 m	(80 ft)
e. Local Road	18 m[1]	(60 ft)
2. Urban		
a. Major Thoroughfare other than Freeway and Expressway	27 m	(90 ft)
b. Minor Thoroughfare	21 m	(70 ft)
c. Local Street	18 m[1]	(60 ft)
d. Cul-de-sac	Variable[2]	

The subdivider will only be required to dedicate a maximum of 30 meters (100 ft) of right-of-way. In cases where over 30 meters (100 ft) of right-of-way is

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[1] The desirable minimum right-of-way (ROW) is 18 meters (60 ft). If curb and gutter is provided, 15 meters (50 ft) of ROW is adequate on local residential streets.

[2] The ROW dimension will depend on radius used for vehicular turn around. Distance from edge of pavement of turn around to ROW should not be less than distance from edge of pavement to ROW on street approaching turn around.

desired, the subdivider will be required only to reserve the amount in excess of 30 meters (100 ft). On all cases in which right-of-way is sought for a fully controlled access facility, the subdivider will only be required to make a reservation. It is strongly recommended that subdivisions provide access to properties from internal streets, and that direct property access to major thoroughfares, principle and minor arterials, and major collectors be avoided. Direct property access to minor thoroughfares is also undesirable. A partial width right-of-way, not less than 18 meters (60 ft) in width, may be dedicated when adjoining undeveloped property that is owned or controlled by the subdivider; provided that the width of a partial dedication be such as to permit the installation of such facilities as may be necessary to serve abutting lots. When the said adjoining property is sub-divided, the remainder of the full required right-of-way shall be dedicated.

B. Street Widths - Widths for street and road classifications other than local shall be as recommended by the Thoroughfare Plan. Width of local roads and streets shall be as follows:

1. Local Residential
   Curb and Gutter section: 7.8 meters (26 ft), face to face of curb
   Shoulder section: 6.0 meters (20 ft) to edge of pavement, 1.2 meters (4 ft) for shoulders

2. Residential Collector
   Curb and Gutter section: 10.2 meters (34 ft), face to face of curb
   Shoulder section: 6.0 meters (20 ft) to edge of pavement, 1.8 meters (6 ft) for shoulders

C. Geometric Characteristics - The standards outlined below shall apply to all subdivision streets proposed for addition to the State Highway System or Municipal Street System. In cases where a subdivision is sought adjacent to a proposed thoroughfare corridor, the requirements of dedication and reservation discussed under Right-of-Way shall apply.

1. Design Speed - The design speed for a roadway should be a minimum of 10 km/h (5 mph) greater than the posted speed limit. The design speeds for subdivision type streets shall be:

DESIGN SPEEDS (METRIC)			
Facility Type	Design Speed km/h Desirable	Minimum Level	Minimum Rolling
RURAL			
Minor Collector Roads (ADT Over 2000)	100	80	60
Local roads including Residential Collectors and Local Residential (ADT Over 400)	80	80	60
URBAN			
Major Thoroughfares other than Freeway or Expressway	100	60	60
Minor Thoroughfares	100	50	50
Local Streets	50	50	30

DESIGN SPEEDS (ENGLISH)			
Facility Type	Design Speed mph Desirable	Minimum Level	Minimum Rolling
RURAL			
Minor Collector Roads (ADT Over 2000)	60	50	40
Local roads including Residential Collectors and Local Residential (ADT Over 400)	50	* 50	* 40
URBAN			
Major Thoroughfares other than Freeway or Expressway	60	50	40
Minor Thoroughfares	40	30	30
Local Streets	30	**30	**20

* Based on ADT of 400-750. Where roads serve a limited area and small number of units, can reduce min design speed.

**Based on projected ADT of 50-250.
(Reference NCDOT Metric Design Manual page 1-1B)

2. Maximum and Minimum Grades

a. The maximum grades in percent shall be:

MAXIMUM VERTICAL GRADE (METRIC)

Facility Type	Design Speed (km/h)	Maximum Grade (Percent) Flat	Rolling	Mountainous
RURAL				
Minor Collector Roads*	30	7	10	12
	50	7	9	10
	65	7	8	10
	80	6	7	9
	100	5	6	8
	110	4	5	6
Local roads including Residential Collectors and Local Residential Streets*	30	-	11	16
	50	7	10	14
	65	7	9	12
	80	6	8	10
	100	5	6	-
URBAN				
Major Thoroughfares other than Freeway or Expressway	50	8	9	11
	65	7	8	10
	80	6	7	9
	100	5	6	8
Minor Thoroughfares*	30	9	12	14
	50	9	11	12
	65	9	10	12
	80	7	8	10
	100	6	7	9
	110	5	6	7
Local Streets*	30	-	11	16
	50	7	10	14
	65	7	9	12
	80	6	8	10
	100	5	6	-

* For streets and roads with projected annual average daily traffic less than 250 or short grades less than 150 meters (500 ft) long, grades may be 2% steeper than the values in the above table.

(Reference NCDOT Metric Design Manual page 1-12 T-3)

MAXIMUM VERTICAL GRADE (ENGLISH)				
Facility Type	Design Speed (mph)	Maximum Grade (Percent) Flat	Rolling	Mountainous
RURAL				
Minor Collector Roads*	20	7	10	12
	30	7	9	10
	40	7	8	10
	50	6	7	9
	60	5	6	8
	70	4	5	6
Local roads including Residential Collectors and Local Residential Streets*	20	-	11	16
	30	7	10	14
	40	7	9	12
	50	6	8	10
	60	5	6	-
URBAN				
Major Thoroughfares other than Freeway or Expressway	30	8	9	11
	40	7	8	10
	50	6	7	9
	60	5	6	8
Minor Thoroughfares*	20	9	12	14
	30	9	11	12
	40	9	10	12
	50	7	8	10
	60	6	7	9
	70	5	6	7
Local Streets*	20	-	11	16
	30	7	10	14
	40	7	9	12
	50	6	8	10
	60	5	6	-

b. Minimum grade should not be less than 0.5% .

c. Grades for 30 meters (100 ft) each way from intersections (measured from edge of pavement) should not exceed 5%.

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* For streets and roads with projected annual average daily traffic less than 250 or short grades less than 150 meters (500 ft) long, grades may be 2% steeper than the values in the above table.

(Reference NCDOT Metric Design Manual page 1-12 T-3)

3. Minimum Sight Distance - In the interest of public safety, no less than the minimum sight distance applicable shall be provided. Vertical curves that connect each change in grade shall be provided and calculated using the following parameters:

SIGHT DISTANCE (METRIC)					
Design Speed (km/h)	30	50	60	90	100
Stopping Sight Distance					
Minimum (meters)	29.6	57.4	74.3	131.2	157.0
Desirable (meters)	30	70	90	170	210
Minimum K* Value for:					
Crest curve	3	9	14	43	62
Sag curve	4	11	15	30	37
Passing Sight Distance:					
Minimum Passing Dist for two lanes, in m	*	*	*	*	*

(General practice calls for vertical curves to be multiples of 10 meters. Calculated lengths shall be rounded up in each case.)
* Currently under revision.
(Reference NCDOT Metric Design Manual page 1-12 T-1)

SIGHT DISTANCE (ENGLISH)				
Design Speed, MPH	30	40	50	60
Stopping Sight Distance:				
Minimum (ft.)	200	275	400	525
Desirable (ft.)	200	325	475	650
Minimum K* Value for:				
Crest Curve	30	60	110	190
Sag Curve	40	60	90	120
Passing Sight Distance:				
Minimum Passing Distance for 2 lanes, in feet	1,100	1,500	1,800	2,100

(General practice calls for vertical curves to be multiples of 50 feet. Calculated lengths shall be rounded up in each case.)
(Reference NCDOT Metric Design Manual page 1-12 T-1)

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* K is a coefficient by which the algebraic difference in grade may be multiplied to determine the length of the vertical curve which will provide the desired sight distance. Sight distance provided for stopped vehicles at intersections should be in accordance with "A Policy on Geometric Design of Highways and Streets, 1994".

4. The "Superelevation Table" shown below shows the minimum radius and the related maximum superelevation for design speeds. The maximum rate of roadway superelevation (e) for rural roads with no curb and gutter is 0.08. The maximum rate of superelevation for urban streets with curb and gutter is 0.06, with 0.04 being desirable.

SUPERELEVATION TABLE (METRIC)		
Design Speed	Maximum e*	Minimum Radius m
50 km/h	0.04	100
65	0.04	175
80	0.04	280
100	0.04	490
50	0.06	90
65	0.06	160
80	0.06	250
100	0.06	435
50	0.08	80
65	0.08	145
80	0.08	230
100	0.08	395

e = rate of roadway superelevation, meter per meter

SUPERELEVATION TABLE (ENGLISH)			
Design Speed	Maximum e*	Minimum Radius ft.	Max. Deg. of Curve
30 mph	0.04	302	19 00′
40	0.04	573	10 00′
50	0.04	955	6 00′
60	0.04	1,637	3 45′
30	0.06	273	21 00′
40	0.06	521	11 15′
50	0.06	955	6 45
60	0.06	1,432	4 15′
30	0.08	260	22 45′
40	0.08	477	12 15′
50	0.08	819	7 30′
60	0.08	1,146	4 45′

* e = rate of roadway superelevation, foot per foot
(Reference NCDOT Metric Design Manual page 1-12 T-6 thru T-8)

D. Intersections

1. Streets shall be laid out so as to intersect as nearly as possible at right angles, and no street should intersect any other street at an angle less than sixty-five (65) degrees.

2. Property lines at intersections should be set so that the distance from the edge of pavement, of the street turnout, to the property line will be at least as great as the distance from the edge of pavement to the property line along the intersecting streets. This property line can be established as a radius or as a sight triangle. Greater offsets from the edge of pavement to the property lines will be required, if necessary, to provide sight distance for the stopped vehicle on the side street.

3. Off-set intersections are to be avoided. Intersections which cannot be aligned should be separated by a minimum length of 60 meters (200 ft) between survey center lines.

E. Cul-de-sacs

Cul-de-sacs shall not be more than 150 meters (500 ft) in length. The distance from the edge of pavement on the vehicular turn around to the right-of-way line should not be less than the distance from the edge of pavement to right-of-way line on the street approaching the turn around. Cul-de-sacs should not be used to avoid connection with an existing street or to avoid the extension of an important street.

F. Alleys

1. Alleys shall be required to serve lots used for commercial and industrial purposes except that this requirement may be waived where other definite and assured provisions are made for service access. Alleys shall not be provided in residential subdivisions unless necessitated by unusual circumstances.

2. The width of an alley shall be at least 6.0 meters (20 ft).

3. Dead end alleys shall be avoided where possible, but if unavoidable, shall be provided with adequate turn around facilities at the dead end as may be required by the Planning Board.

G. Permits For Connection To State Roads

An approved permit is required for connection to any existing state system road. This permit is required prior to any construction on the street or road. The application is available at the office of the District Engineer of the Division of Highways.

H. Offsets To Utility Poles

Poles for overhead utilities should be located clear of roadway shoulders, preferably a minimum of at least 9.0 meters (30 ft) from the edge of pavement. On streets with curb and gutter, utility poles shall be set back a minimum distance of 1.8 meters (6 ft) from the face of curb.

I. Wheel Chair Ramps

All street curbs being constructed or reconstructed for maintenance purposes, traffic operations, repairs, correction of utilities, or altered for any reason, shall provide wheelchair ramps for the physically handicapped at intersections where both curb and gutter and sidewalks are provided and at other major points of pedestrian flow.

J. Horizontal Width on Bridge Deck

1. The clear roadway widths for new and reconstructed bridges serving 2 lane, 2 way traffic should be as follows:

a. Shoulder section approach

i. Under 800 ADT design year

Minimum 8.4 meters (28 ft) width face to face of parapets, rails, or pavement width plus 3.0 meters (10 ft), whichever is greater.

ii. 800 - 2000 ADT design year

Minimum 10.2 meters (34 ft) width face to face of parapets, rails, or pavement width plus 3.6 meters (12 ft), whichever is greater.

iii. Over 2000 ADT design year

Minimum width of 12 meters (40 ft), desirable width of 13.2 meters (44 ft) width face to face of parapets or rails.

b. Curb and gutter approach

i. Under 800 ADT design year

Minimum 7.2 meters (24 ft) face to face of curbs.

ii. Over 800 ADT design year

Width of approach pavement measured face to face of curbs.

Where curb and gutter sections are used on roadway approaches, curbs on bridges shall match the curbs on approaches in height, in width of face to face of curbs, and in crown drop. The distance from face of curb to face of parapet or rail shall be a minimum of 450 millimeters (1' 6"), or greater if sidewalks are required.

2. The clear roadway widths for new and reconstructed bridges having 4 or more lanes serving undivided two-way traffic should be as follows:

   a. Shoulder section approach - Width of approach pavement plus width of usable shoulders on the approach left and right. (Shoulder width 2.4 m (8 ft) minimum, 3.0 m (10 ft) desirable.)

   b. Curb and gutter approach - Width of approach pavement measured face to face of curbs.

APPENDIX D2

LEVEL OF SERVICE

A good indication of the adequacy of the existing major street system is a comparison of the traffic volumes with the ability of the streets to move traffic freely at a desirable speed. The ability of a street to move traffic freely, safely, and efficiently with a minimum delay is controlled principally by the spacing of major devices utilized. Thus, the ability of a street to move traffic can be increased by restricting parking and turning movements, using proper sign and signal devices, and by the application of other traffic engineering techniques.

Capacity is defined as the maximum number of vehicles that have a reasonable expectation of passing over a given section of a roadway in one direction, or in both directions, during a given period under prevailing roadway and traffic conditions.[1] The relationship of traffic volumes to the capacity of the roadway will determine the **level of service** being provided. Six levels of service have been selected to identify the conditions existing under various speed and volume conditions on a highway or street.

The six levels of service are illustrated in Figure D1, and they are defined on the following page. The definitions are general and conceptual in nature, but may be applied to urban arterial levels of service. Levels of service for interrupted flow facilities vary widely in terms of both the user's perception of service quality and the operational variables used to describe them. Each chapter of the 1994 Highway Capacity Manual contains more detailed descriptions of the levels of service as defined for each facility type.

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[1] Highway Capacity manual, Special Report 209, 1994, p. 3:7-11.

1. **Level-of-service A** describes primarily free flow operations at average travel speeds, usually about 90 percent of the free flow speed for the arterial class. Vehicles are completely unimpeded in their ability to maneuver within the traffic stream. Stopped delay at signalized intersections is minimal.

2. **Level-of-service B** represents reasonable unimpeded operations at average travel speeds, usually about 70 percent of the free flow speed for the arterial class. The ability to maneuver within the traffic stream is only slightly restricted and stopped delays are not bothersome. Drivers are not generally subjected to appreciable tension.

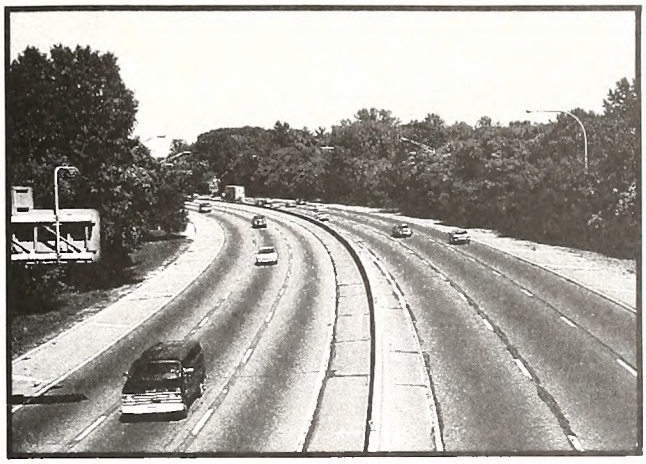
3. **Level-of-service C** represents stable operations. However, ability to maneuver and change lanes in midblock locations may be more restricted than in LOS B, and longer queues and/or adverse signal coordinations may contribute to lower average travel speeds of about 50 percent of the average free flow speed for the arterial class. Motorists will experience an appreciable tension while driving.

4. **Level-of-service D** borders on a range on which small increases in flow may cause substantial increases in approach delay and, hence, decreases in arterial speed. They may be due to adverse signal progression, inappropriate signal timing, high volumes, or some combination of these. Average travel speeds are about 40 percent of free flow speed.

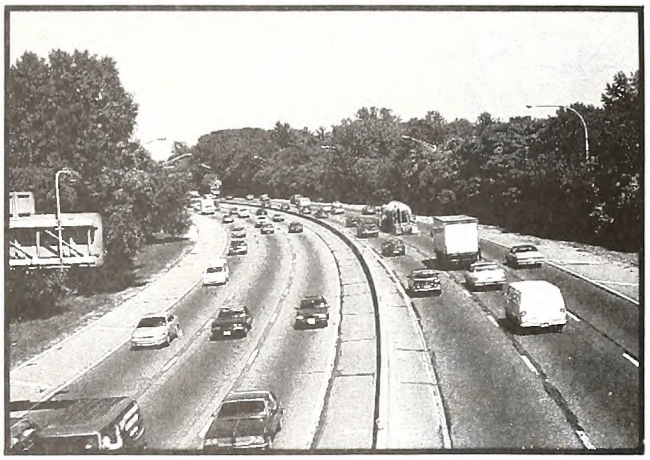
5. **Level-of-service E** is characterized by significant approach delays and average travel speeds of one-third the free flow speed or lower. Such operations are caused by some combination of adverse progression, high signal density, extensive queuing at critical intersections, and inappropriate signal timing.

6. **Level-of-service F** characterizes arterial flow at extremely low speeds below one-third to one-quarter of the free flow speed. Intersection congestion is likely at critical signalized locations, with high approach delays resulting. Adverse progression is frequently a contributor to this condition.

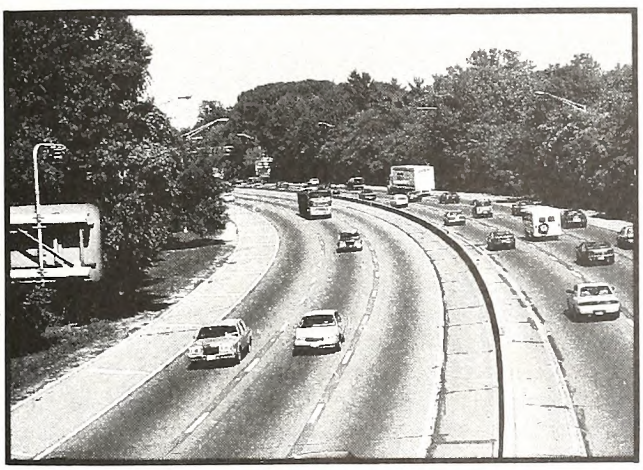
Source: 1994 Highway Capacity Manual



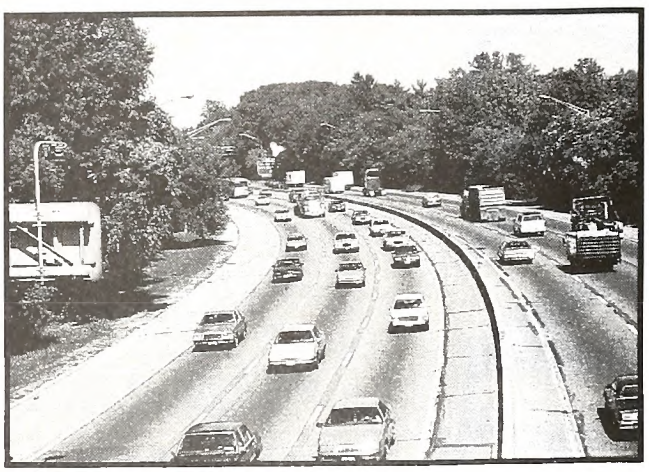
LOS A.



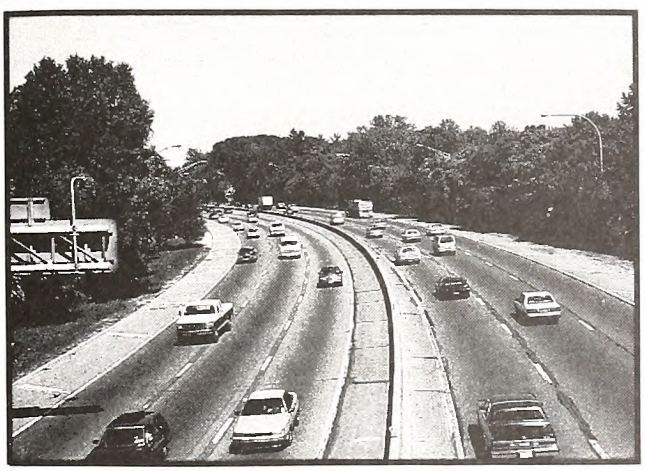
LOS D.



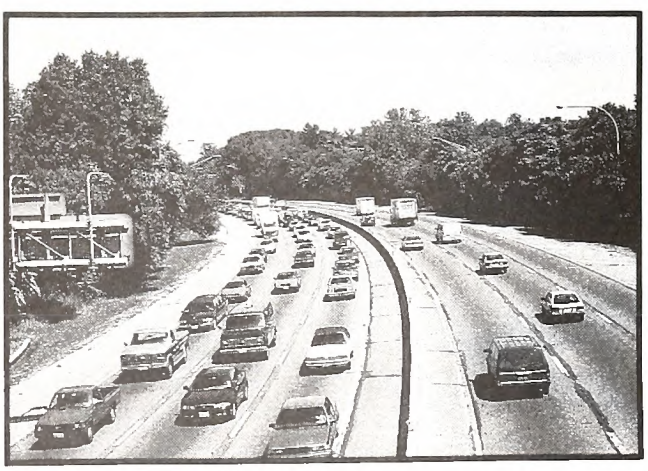
LOS B.



LOS E.



LOS C.



LOS F.

LEVELS OF SERVICE

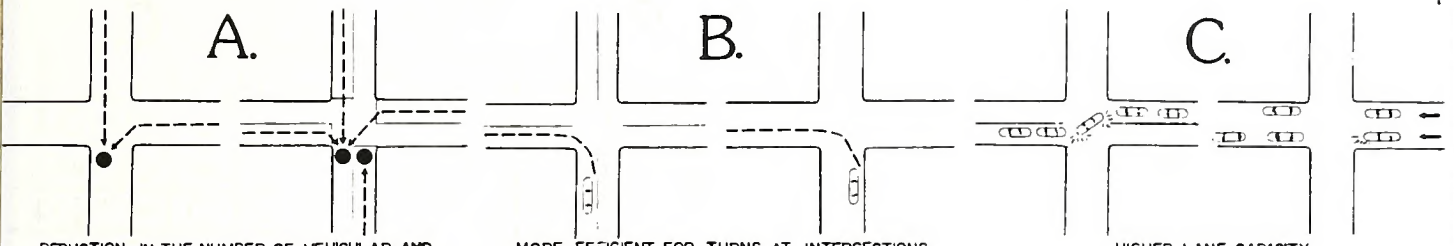
FIGURE D2–1

APPENDIX E

APPENDIX E

ONE-WAY STREETS

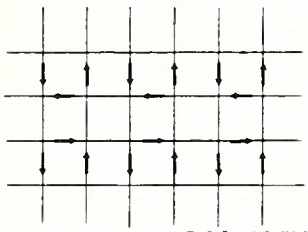
I. ADVANTAGES OF THE ONE-WAY SYSTEM



REDUCTION IN THE NUMBER OF VEHICULAR AND PEDESTRIAN CONFLICTS.

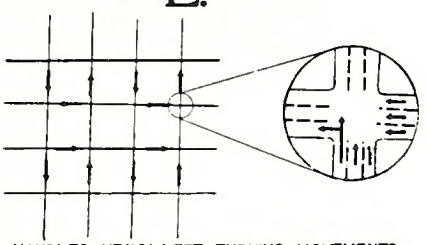
MORE EFFICIENT FOR TURNS AT INTERSECTIONS.

HIGHER LANE CAPACITY

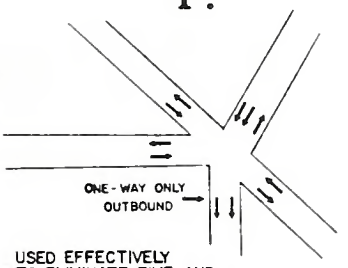


EASIER TO COORDINATE SIGNALS IN A ONE-WAY SYSTEM

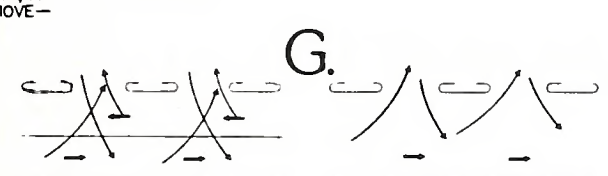
FOR A CONTINUOUS STREET, TRAFFIC SIGNAL COORDINATION IS IMPROVED GREATLY. FOR THE ENTIRE BLOCK SYSTEM IN THE CENTRAL AREA, IF BLOCK SPACING IS REASONABLY UNIFORM, IT IS POSSIBLE TO COORDINATE FOR ALL MOVEMENTS.



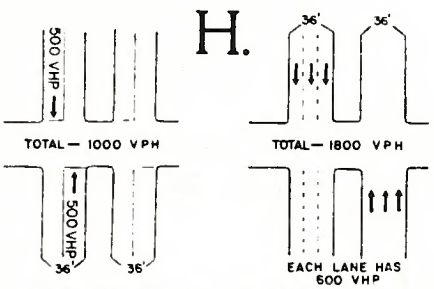
HANDLES HEAVY LEFT TURNING MOVEMENTS



USED EFFECTIVELY TO ELIMINATE FIVE AND SIX SIDED INTERSECTIONS.

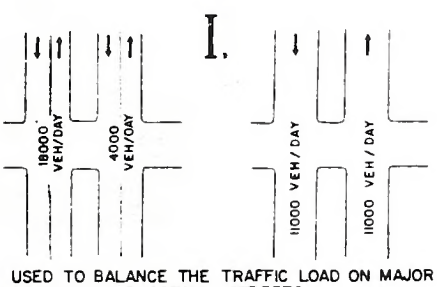


LESS FRICTION FROM OFF-STREET PARKING AREAS, SERVICE STATIONS, EMERGENCY VEHICLES, ETC.

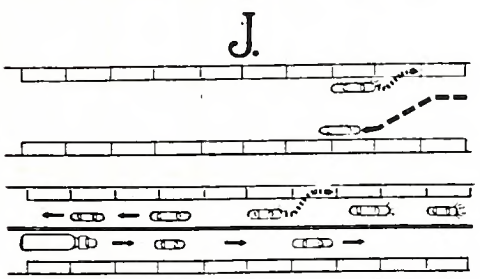


INCREASES THE CAPACITY OF THE TRAFFIC SYSTEM WHERE STREET WIDTHS GIVE AN ODD NUMBER OF LANES.

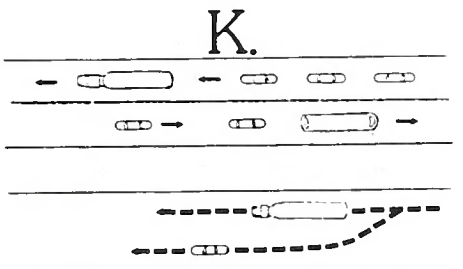
IN GENERAL, NARROWER LANES CAN BE USED. A 10 FOOT LANE ON A ONE-WAY STREET WILL HAVE AS MUCH CAPACITY AS 11 OR 12 FOOT LANES ON TWO-WAY STREETS.



USED TO BALANCE THE TRAFFIC LOAD ON MAJOR RADIAL OR CROSSTOWN STREETS.



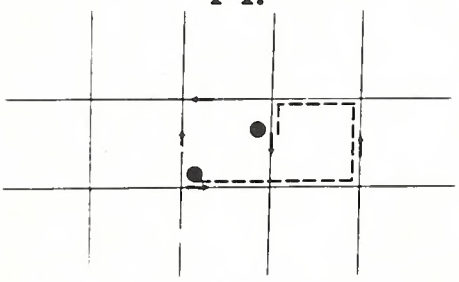
ON ONE-WAY STREETS, TRAFFIC CAN MOVE AROUND PARKING OR DELIVERY VEHICLES.



ONE-WAY PAIRS PERMIT PASSENGER VEHICLES TO PASS COMMERCIAL VEHICLES.

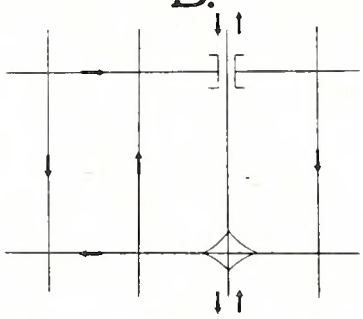
II. DISADVANTAGES OF THE ONE-WAY SYSTEM

A.



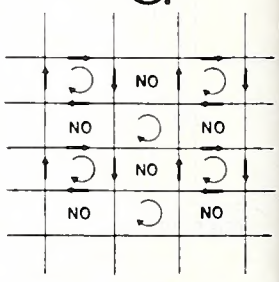
CERTAIN TRIPS MAY BE MADE LONGER BECAUSE OF THE ORIENTATION OF THE ONE-WAY STREETS.

B.



ONE-WAY STREET SYSTEMS, IF USED IMPROPERLY, CAN BE VERY CONFUSING TO THE DRIVING PUBLIC.

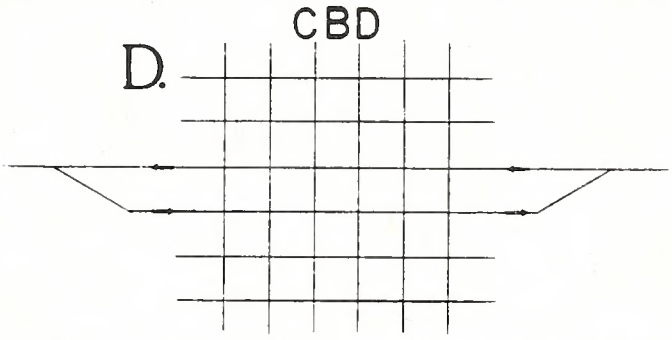
C.



MAY HAVE A DETRIMENTAL EFFECT ON SOME BUSINESS AREAS OR LAND USES.

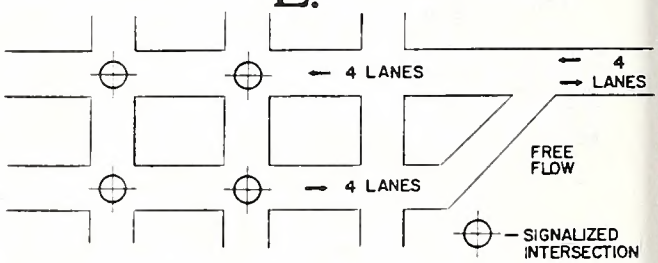
III. SPECIFIC USES OF THE ONE-WAY SYSTEM

D.



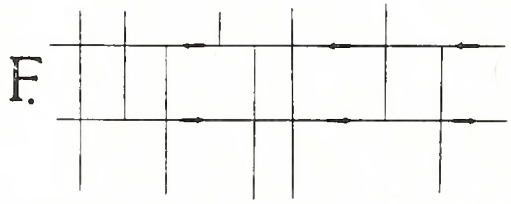
TO OBTAIN MORE CAPACITY FOR MAJOR RADIAL STREETS MOVING TO THE BUSINESS AREA.

E.



TO EQUALIZE CAPACITY IN THE CENTRAL AREA AT THE TERMINAL OF A FREE FLOWING RADIAL.

F.

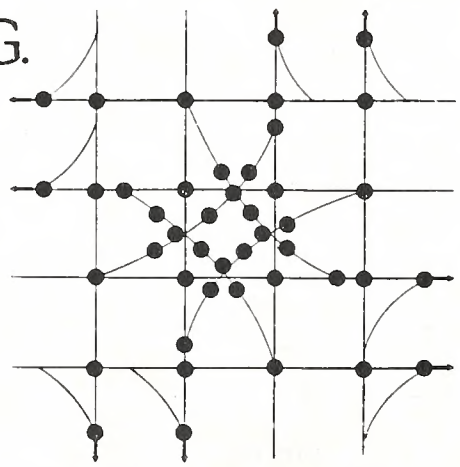


FOR CENTRAL AREAS WITH A LARGE NUMBER OF OFFSET INTERSECTIONS. (TO IMPROVE SIGNAL OPERATION AND REDUCE TURNING CONFLICTS)

IV. SAFETY

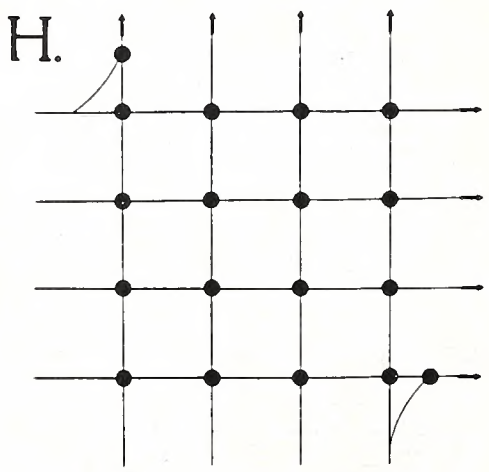
ACCIDENT FREQUENCY WILL BE REDUCED WITH A PROPERLY ENGINEERED ONE-WAY SYSTEM.

G.



TWO-WAY — 44 POSSIBLE CONFLICTS

H.



ONE-WAY — 18 POSSIBLE CONFLICTS